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Digistrip III

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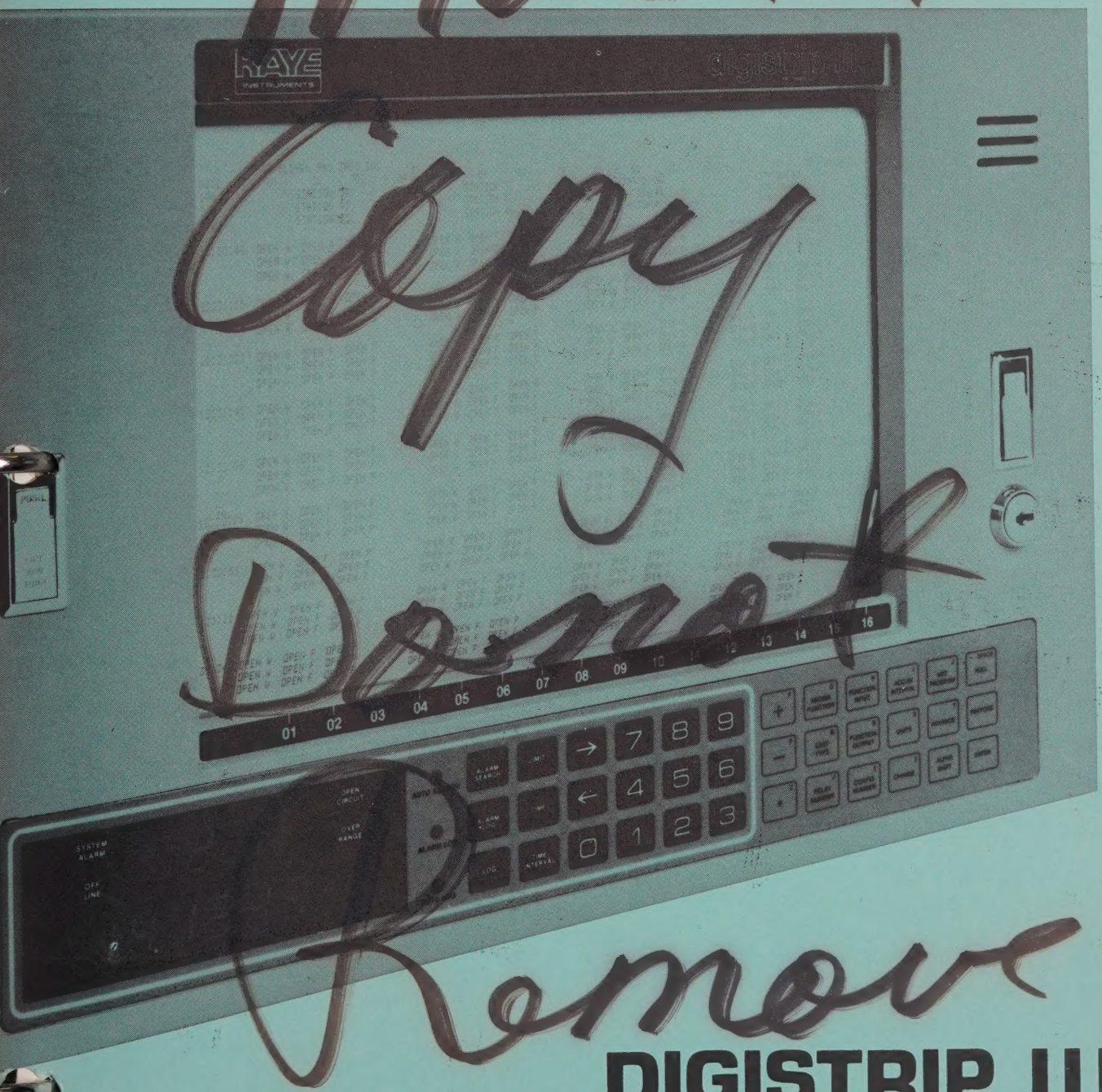

DIGISTRIP III
USER'S GUIDE

FOREWORD

The *Digistrip III User's Guide* provides instructions on the installation, programming and operation of the Digistrip III Process Monitor. After carefully studying the information contained in this guide, an operator will be prepared to set up, program and run the instrument for most applications.

Some customers will be using the Digistrip III Process Monitor for special applications. Instructions for such applications are contained in the *Digistrip III User's Guide Supplement.*

For additional assistance or information, please contact your nearest Kaye representative or the factory.

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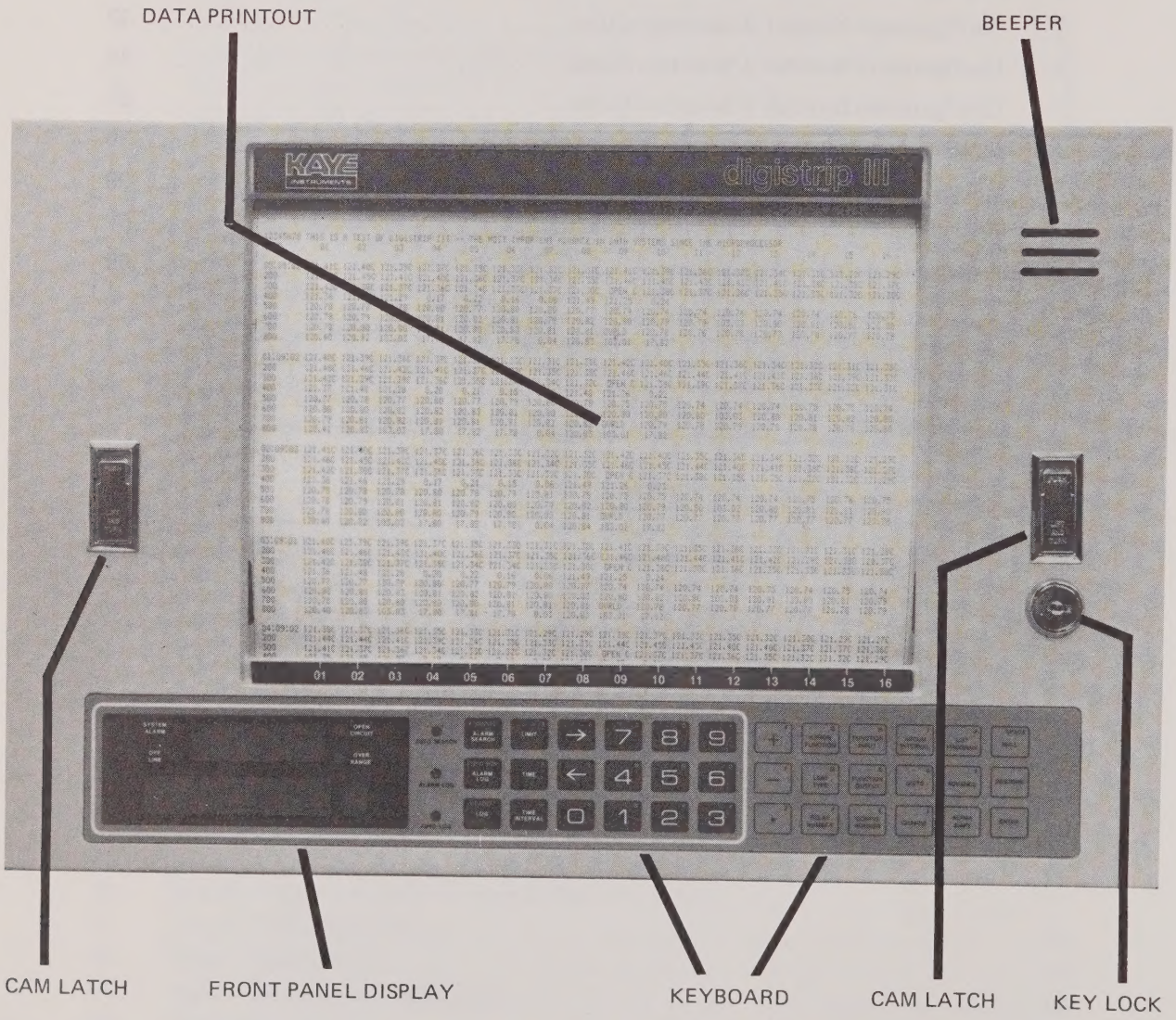


FIGURE 1. DIGISTRIP III – FRONT VIEW

MAJOR FEATURES

The Digistrip III is a multi-input process monitor which is suited for operation on a bench top, for mounting in a rack, or for installation in an instrument panel. Figures 1 and 2 show the front and rear views of the unit, respectively. Figure 3 is an operational block diagram.

The Digistrip III is a "computerized" instrument—its operation is based on an internal microprocessor which must be programmed (instructed) by the user with the "guidelines" which apply to a specific application. The unit is programmed and operated by using the front panel keyboard (Figure 4). Both Program Mode and Run (operating) Mode functions are performed by making a logical sequence of keyboard entries. When an entry is made, the entered information appears in the front panel LED display. Correct entries are indicated by a short beep tone. An incorrect entry is rejected, and a long beep tone is sounded.

The instrument also includes an internal printer which provides a permanent record of process data on 8½ x 11 fanfold paper (Figure 5).

Terminal blocks on the back of each instrument can handle up to 48 analog inputs. When equipped with one or more external scanners, the unit can handle up to 128 inputs in serial data form.

The Digistrip III is equipped with a broad range of operating features:

- Basic operations provide for the processing of inputs from thermocouples, RTDs, pressure transducers, etc. Once the appropriate instructions have been programmed into the unit, data received via the inputs is automatically scaled into applicable engineering units, compared to specified alarm limits, then printed out and/or transmitted to a computer.
- The unit's memory contains a large library of mathematical calculating functions. These functions make possible the automatic calculation and recording of information such as equivalent sterilization time, maximum/minimum/average input data values, flow rates, and tank volumes.
- There are several features included in the Digistrip III to increase its communications ability:
  - The alarm message feature may be used to direct the operator's actions.
  - The serial transmission start-and-end message feature is used when communicating with a computer.
  - When the Digistrip III is operating in conjunction with a computer, messages sent by the computer can be printed out by the Digistrip III's internal printer.
- Specialized features which provide a level of measurement accuracy and convenience never before available in the Digistrip line include:
  - A high resolution (0.01°C) linearization scale for Type T thermocouples.
  - An automatic curve calibration technique.
  - Cassette program loading capabilities.

A variety of optional equipment may be used to increase the capabilities of a Digistrip III. Options available include: an analog input scanner, frequency and digital scanners, an external relay control system, and a cassette program loader. Precision high and low temperature calibration references are also available.

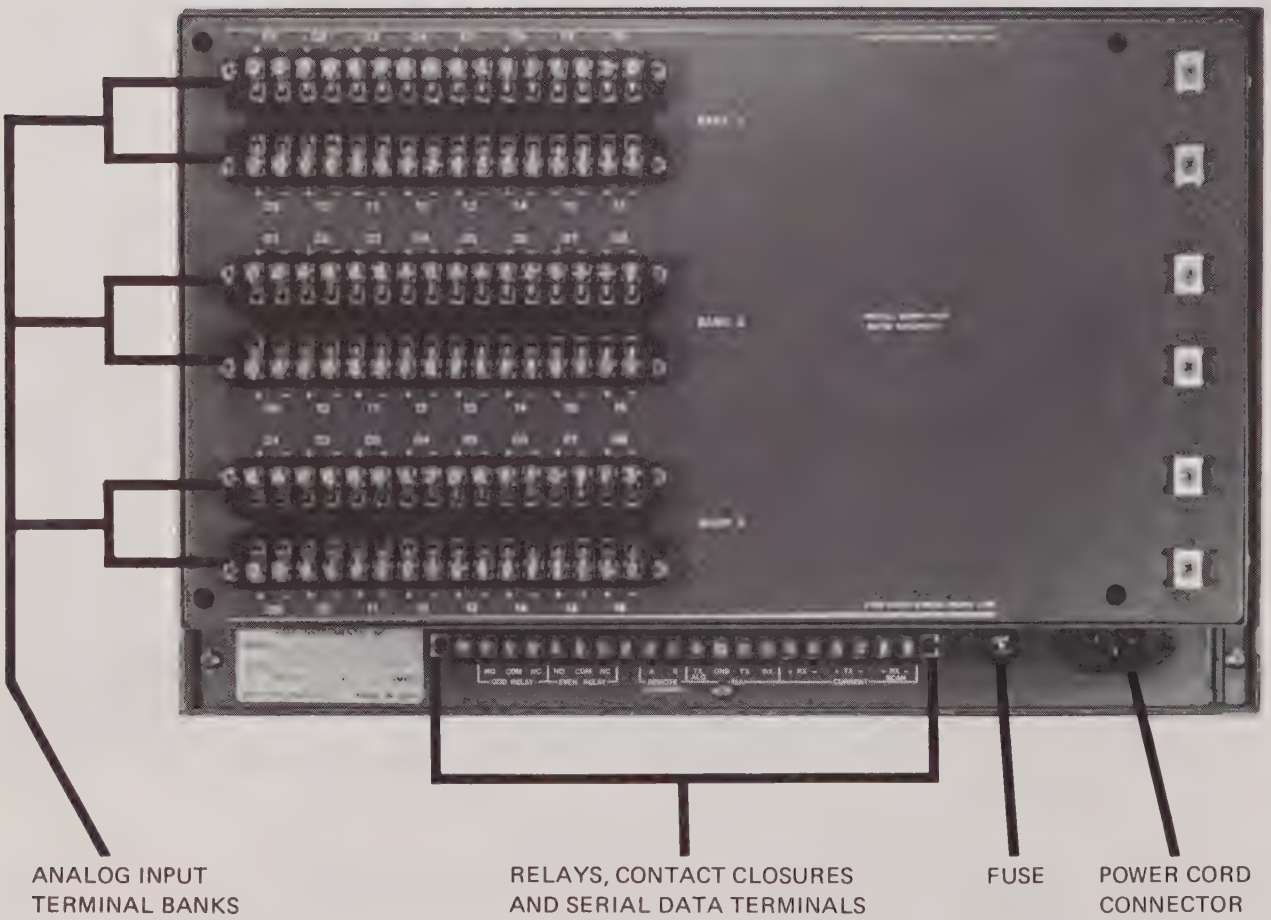
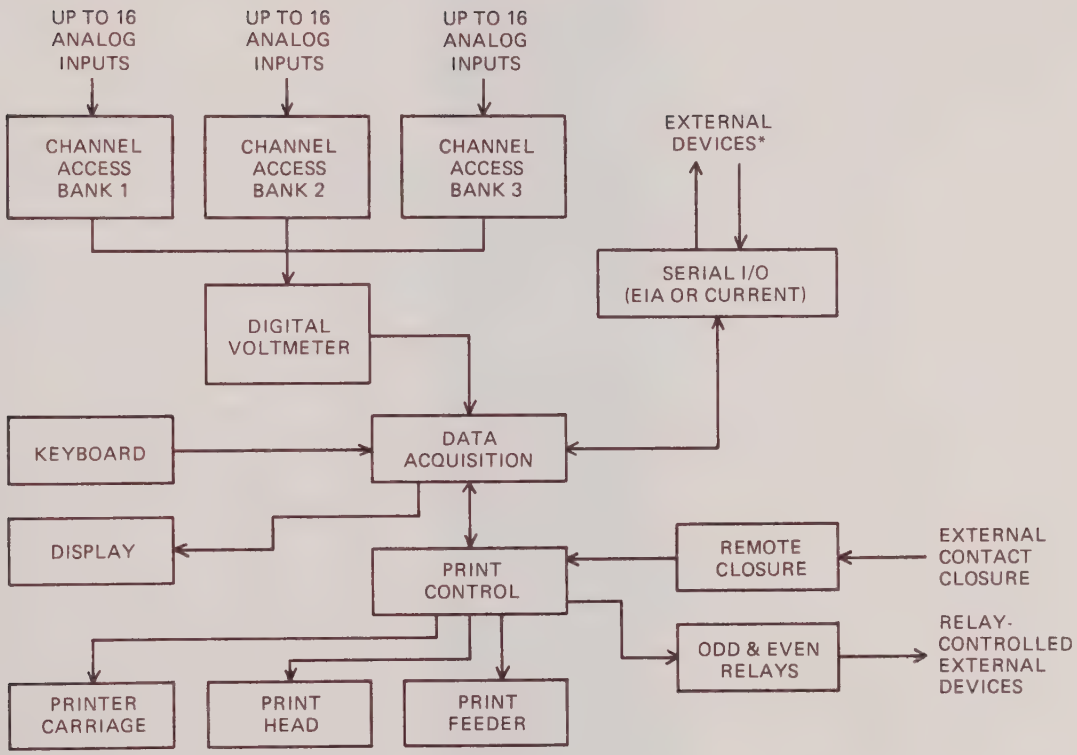


FIGURE 2. DIGISTRIP III – REAR VIEW



**External Devices include computers, input scanners, external relay drivers, cassette program loaders, etc.*

THEORY OF OPERATION

The Digistrip III is designed around two microprocessors (one on the Data Acquisition Board and one on the Print Control Board) which together control the data collection, scaling, alarm and output operations of the instrument. A calculator chip (integrated circuit) on the Data Acquisition Board allows the unit to perform sophisticated calculations on data after it has been collected. Program parameters are entered via the keyboard to determine how the Digistrip III will process the input data. The design of the Digistrip III incorporates a "decoupled architecture" in which scanning, data processing and output may proceed independent of each other.

Analog to Digital Conversion – The Digital Voltmeter (DVM) receives analog input from one to three channel access boards (scanners). Each channel is scanned sequentially, and its analog voltage is converted to an equivalent digital code.

Data Scaling and Display – The digital output from the DVM is transmitted to the Data Acquisition Board for scaling, alarm checking, calculations, and storage in the Random Access Memory. The Data Acquisition Board controls the display of data, either through the keyboard-entered Channel Address or through automatic means such as the automatic Alarm Search and display. Data for the serial data port (Serial I/O) is transmitted from the Data Acquisition Board to devices such as a magnetic tape recorder or minicomputer for further data reduction.

Print Control – The Print Control Board controls the print head (printing) and paper feed (advance) operations. Data for the Print Control Board is supplied via a buffer located on the Data Acquisition Board. Use of this buffer allows the printer, which operates at a slower rate than the input scanners, to print data from a single scan cycle and minimizes time delay.

FIGURE 3. DIGISTRIP III – OPERATIONAL BLOCK DIAGRAM

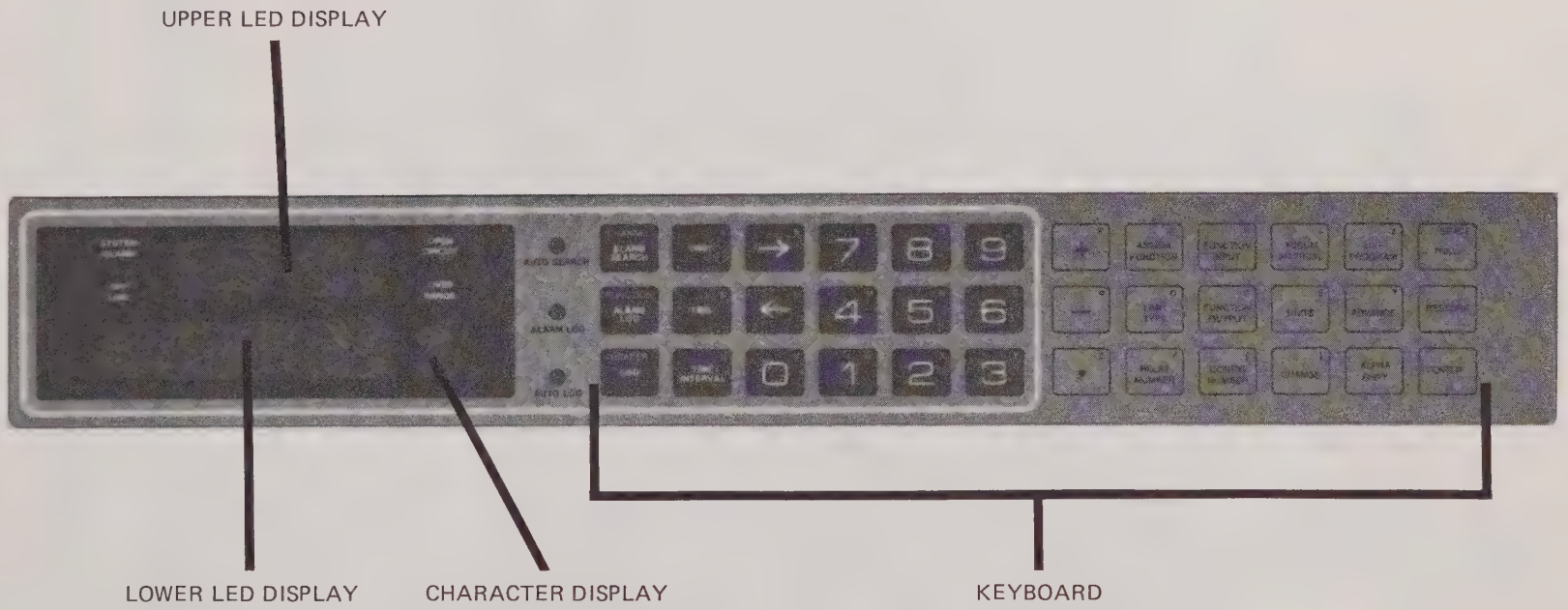


FIGURE 4. KEYBOARD AND DISPLAY PANEL

12 PAN WORLD INDUSTRIES BUILDING 6 CO-GENERATION PLANT PLANT STATUS MONITOR
1125 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
100 GAS TURBINE OPERATING PARAMETERS
200 STG 1-1 STG 1-2 STG 1-3 STG 2-1 STG 2-2 STG 2-3 STG 3-1 STG 3-2 STG 3-3 AVE TEMP MIN. LOCATION DEV RPM VIB. MILS
300 GENERATOR PARAMETERS STEAM PRODUCTION UNIT LOW PRESSURE TURBINE
400 GEN. MW MW-HRS FWD BRG AFT BRG BRG.PLAY EXH GAS ST.TEMP ST.PRES DELTA P LBS/HR TOTL LBS TURB.KW KW-HRS FWD BRG AFT BRG VIB.

12:52:20	635.0C	408.2C	397.8C	404.3C	404.3C	403.0C	405.6C	403.0C	409.5C	430.0	397.8	103	32.2	1300	0.00		
200	0.687W	0.00M	32.0C	31.7C	1.6P	31.3C	32.2C	6.2P	1.6P	14.3	0.5P	3.050K	0.16K	31.9C	31.8C	0.21M	
12:53:20	632.5C	409.5C	401.7C	404.3C	405.6C	405.6C	405.6C	404.3C	409.5C	430.9	401.7	103	29.2	1330	0.00		
200	0.692W	0.02M	32.3C	32.1C	1.7P	31.3C	32.4C	6.5P	1.7P	15.0	1.9P	3.262K	0.70K	32.3C	32.2C	0.21M	
12:53:40	635.0C	408.2C	400.4C	404.3C	405.6C	404.3C	404.3C	403.0C	408.2C	430.3	400.4	103	29.9	1315	0.00		
200	0.685W	0.02M	32.2C	32.0C	1.6P	31.3C	32.3C	6.4P	1.6P	14.5	2.4P	3.212K	0.88K	32.2C	32.1C	0.21M	
12:54:00	635.0C	406.9C	400.4C	403.0C	404.3C	403.0C	403.0C	403.0C	406.9C	429.5	400.4	103	29.2	1295	0.00		
200	0.675W	0.02M	32.2C	31.9C	1.6P	31.2C	32.2C	6.3P	1.6P	14.4	2.9P	3.150K	1.05K	32.1C	32.0C	0.21M	
12:54:20	637.5C	405.6C	399.1C	401.7C	403.0C	403.0C	401.7C	401.7C	406.9C	429.0	399.1	103	29.9	1270	0.00		
200	0.662W	0.03M	32.1C	31.8C	1.6P	31.1C	32.1C	6.1P	1.6P	14.2	3.4P	3.112K	1.23K	32.1C	31.9C	0.20M	
12:54:40	635.0C	405.6C	397.8C	400.4C	401.7C	401.7C	400.4C	400.4C	405.6C	427.6	397.8	103	29.8	1250	0.00		
200	0.652W	0.03M	32.0C	31.7C	1.6P	31.0C	32.0C	6.0P	1.6P	14.1	3.9P	3.075K	1.40K	32.0C	31.9C	0.20M	
12:55:00	635.0C	404.3C	396.5C	400.4C	401.7C	400.4C	400.4C	400.4C	404.3C	427.0	396.5	103	30.5	1235	0.00		
200	0.640W	0.03M	31.9C	31.6C	1.5P	30.9C	31.9C	5.9P	1.5P	13.6	4.3P	3.050K	1.57K	31.9C	31.8C	0.20M	
12:55:20	635.0C	410.8C	400.4C	406.9C	406.9C	404.3C	408.2C	405.6C	412.1C	432.2	400.4	103	31.8	1340	0.00		
200	0.705W	0.04M	32.2C	32.0C	1.7P	31.6C	32.5C	6.4P	1.7P	14.9	4.8P	3.237K	1.74K	32.3C	32.2C	0.22M	
12:55:40	637.5C	414.7C	406.9C	410.8C	410.8C	409.5C	412.1C	409.5C	414.7C	436.2	406.9	103	29.3	1420	0.00		
200	0.742W	0.04M	32.7C	32.5C	1.8P	31.8C	32.9C	6.9P	1.8P	15.8	5.3P	3.500K	1.94K	32.7C	32.6C	0.23M	
12:56:00	637.5C	414.7C	408.2C	412.1C	412.1C	410.8C	412.1C	410.8C	416.0C	437.1	408.2	103	28.9	1445	0.00		
200	0.752W	0.05M	32.9C	32.7C	1.8P	31.8C	33.1C	7.0P	1.8P	15.9	5.9P	3.550K	2.13K	32.9C	32.8C	0.23M	
12:56:20	637.5C	416.0C	409.5C	413.4C	413.4C	412.1C	412.1C	412.1C	416.0C	438.0	409.5	103	28.5	1460	0.00		
200	0.757W	0.05M	32.9C	32.7C	1.8P	31.8C	33.1C	7.1P	1.8P	16.0	6.4P	3.587K	2.33K	33.0C	32.8C	0.23M	
12:56:40	637.5C	414.7C	408.2C	412.1C	413.4C	412.1C	412.1C	410.8C	416.0C	437.4	408.2	103	29.2	1455	0.00		
200	0.755W	0.05M	33.0C	32.7C	1.8P	31.8C	33.1C	7.1P	1.8P	16.0	6.9P	3.587K	2.53K	33.0C	32.8C	0.23M	
12:57:00	637.5C	416.0C	408.2C	412.1C	413.4C	412.1C	412.1C	412.1C	416.0C	437.7	408.2	103	29.5	1455	0.00		
200	0.752W	0.06M	33.0C	32.7C	1.8P	31.8C	33.1C	7.1P	1.8P	16.0	7.5P	3.587K	2.73K	33.0C	32.8C	0.23M	

FIGURE 5. SAMPLE DATA PRINTOUT

INTRODUCTION

Kaye Instruments' sales and service engineers have trained many customers in the proper use of the Digistrip line of process monitors. Over the years, they have found that the individual users/operators whom they have trained fall into two general groups: (1) those who have used computers or computerized instruments and understand how they work, and (2) those who know very little — sometimes nothing — about such equipment.

For those in the first group, the training process is usually straightforward. They are familiar with the theory of how computerized equipment works, and it is only necessary for the sales engineer to teach them how this particular instrument functions and how to operate it correctly.

For those in the second group, the training process is often a bit more difficult. The sales engineers have found that the major problem is "fear of the unknown." There are still a great many people who look upon computers as "thinking" machines, as if they have minds of their own and do what *they* want to do. To confuse the matter even further, when an instructor starts talking about running the equipment or the beginner starts reading the user's guide, the words used to describe the instrument and its operation are either totally strange or are common words used in a new way with new meanings. Until they're understood, terms such as *initialization, programming* and *configuration* can seem almost like a foreign language. A familiar word such as *buffer* does not mean something used in polishing or a barrier; in computer terms, it means a location in the computer memory where information is temporarily stored.

For those people who are newcomers to the use of computerized instruments, the Kaye sales engineers begin the training program with a basic explanation of just how the computer function works, with emphasis on the fact that a computer does *not* "think for itself;" it only does what the programmer or operator tells it to do. (In the Digistrip line, the computer function is handled by a microprocessor which is a type of minicomputer.) It is also important, in the very beginning of the training program, for those unfamiliar with computers to learn the meanings of and to understand the technical terms used.

Following is a Glossary of Technical Terms which are used when working with computers in general and with the Digistrip III in particular. Beginners and those who have not used Digistrip instruments before should study the Glossary carefully. If there is anything which is not clearly understood, do not hesitate to ask the Kaye sales engineer to explain it in more detail.

NOTES

In this Glossary, when we refer to specific features of the instrument such as key, keyboard, front panel *and* display, *we are referring to those items shown on Figure 1 as being features of the Digistrip III.*

Several of the terms listed in the Glossary have an asterisk(*) in front of them. This means that the term or its definition is special to the Digistrip III. If you should run across any of these terms when working with another type of equipment, be sure to check their definitions carefully — the terms may be used quite differently from the way we use them for the Digistrip III.

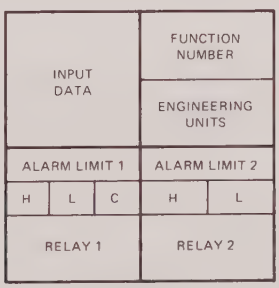
ACCESS — To make available; to use the keyboard to "call up" a memory location.

ACCUMULATION REGISTER — An information storage location in the memory where data can be collected and stored over a specified period of time (for example, flow volume over an 8-hour period).

ANALOG DATA — In a Digistrip III, analog data is a variable voltage which represents the information being monitored (for example, thermocouple readings).

BUFFER — A location in the memory where information is temporarily stored.

***CHANNEL ADDRESS** — A 3-digit number which identifies a particular data processing location within a Digistrip III. Each instrument contains 128 channel addresses (101-116, 201-216, 301-316 . . . 801-816). Each channel address contains a series of memory locations. These locations are shown in the following diagram of a channel address.



***CHANNEL ADDRESS** — A 3-digit number which is assigned to a memory location. A different number is assigned to each location and becomes the means of identifying that location and its contents. See the definition for MEMORY LOCATION.

CHARACTERS — In computer terms, every letter, number, symbol and space is counted as a "character."

GLOSSARY

***CONFIGURATION NUMBER** — In general computer terms, this is a number — defined during programming — which selects a series of basic operating parameters (see definition for PARAMETERS). The Digistrip III requires the definition of four 6-digit configuration numbers which are referred to as *Configuration Number 1, 2, 3* or *4.*

DATA — Basically, data means information. In the case of computers, it means information presented in a manner suitable for electronic communication and processing.

DECREMENT KEY (←) — When pressed, this key causes the channel address or channel function, which is showing in the LED display at that time, to be reduced by one unit. For example, if channel address 211 is showing in the LED display, pressing the Decrement key will cause the displayed number to change to 210; pressing the key again will change the number to 209, etc.

DEFINE, DEFINED, DEFINITION — When discussing computers, these terms are used in referring to information which has been specified by the programmer as part of the programming operation. For example, if the Digistrip III is to be used to monitor temperatures, the acceptable upper and lower temperature limits are specified by the programmer when he programs the instrument; he also specifies whether the temperature reading is to be displayed and printed out in Fahrenheit or Celsius degrees.

DIGIT — A single number: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0

DISABLE — To deactivate an operating feature; to prevent an operating feature from functioning. For example, the printer may be disabled (deactivated) by setting its LOAD/RUN switch to the LOAD position.

DISPLAY — (1) The area at the left side of the front panel (see Figure 1) where illuminated numbers, letters and symbols appear. (2) The series of characters appearing in the display. The characters are made up of light emitting diodes, commonly called LEDs.

ENABLE — To activate or turn on an operating feature.

ENGINEERING UNITS — Standard units of measurement such as psi, rpm, ^{o}C.

ENTERING — The process of programming information into the memory locations by using the keyboard.

HARDWARE — Physical equipment components of a computer-based device; the actual parts of the equipment that you can see and touch, as opposed to Software which is the programming (see definition for SOFTWARE).

***HEADERS** — Identifying information which is programmed to appear at the top of each printout page. For example, the header may include the company name, the location of the equipment, the process being monitored, etc.

INCREMENT KEY (→) — When pressed, this key causes the channel address or channel function number, which is showing in the LED display, to increase by one unit. For example, if channel address 307 is showing in the display, pressing the Increment key once will change the number to 308; pressing the key again will change the number to 309, etc.

***INITIALIZATION** — The process used to clear the memory of all previously programmed information. Initialization is always done in preparation for entering a new program.

INPUT — Data fed into a memory location for processing. This data may be from an external device (thermocouple, etc.) or from another memory location.

KEYBOARD — The rows of touch-sensitive keys on the right side of the front panel. The keyboard is used to enter program instructions, call up the display of channel address data, etc.

KEYING — The act of pressing the touch-sensitive keys. This term is frequently used in this user's guide in the phrase "by keying this sequence."

LOG -- A single printout of the time and current data values for the channel addresses in use.

MEMORY -- The information storage portion of a computer. Since the computer in a Digistrip III is in the form of a microprocessor, the unit's memory is part of the microprocessor.

***MEMORY LOCATION** — An information storage location within a Digistrip III. Memory locations are used to store information such as input data values, alarm limits and function parameters. Each channel address and function number contains a series of memory locations.

MICROPROCESSOR — The miniaturized computer component of a Digistrip III. All calculations and instrument operations are controlled by the microprocessor.

MODE — A type of operation. The Digistrip III operates in either the Program Mode or the Run Mode.

OPERATING PARAMETERS — Defined routines used by the Digistrip III in processing data.

PARAMETERS — The rules, factors or relationships which govern operation of equipment or mathematical equations. For example: in a user-defined linear function, slope and offset are parameters which are defined in programming; in routine programming, channel assignments and function numbers selected by the user are also considered parameters. Parameters for a particular job using the Digistrip III are determined before programming. During programming the applicable parameters are entered into the memory and are then unchangeable during that job. If that Digistrip III is later to be used for another job with different parameters, the memory must be cleared and re-programmed with the new parameters.

GLOSSARY

PRINTOUT — The sheets of paper from a computer-connected printer which contain information requested by the user or information programmed to print out automatically.

PROGRAM MODE — The Digistrip III must be set in PROGRAM mode to allow the operator to program the instrument.

PROGRAMMING — In reference to computers, this is the process of defining a series of operations to be performed on input data. The Digistrip III is programmed by using a combination of keyboard entries and switch settings.

RELAY — An electromechanical switching device. In the Digistrip III, one use of relays is to provide contact closures when an alarm condition is indicated.

RESISTANCE TEMPERATURE DETECTOR (RTD) — An electrical temperature measuring device. The sensing element of an RTD varies in resistance according to its temperature.

RUN MODE — The Digistrip III must be set in RUN mode in order for it to process inputs and to print out and display the processed data.

SCALING — A technique used to convert input measurements to desired engineering units.

SCANNER — An electronic device which samples multiple inputs in a sequential manner; in other words, it scans across a number of inputs, one after another, in a specified order.

SERIAL DATA — A form of computer communication in which encoded information is transmitted sequentially. In Digistrip III use, serial data is used to transmit information to connected computers, etc., and to receive information from external scanners.

SOFTWARE — This is basically another name for a type of programming. When referring to the Digistrip III's software, it means the series of basic operating instructions entered permanently into the memory by Kaye Instruments. In other computers or computerized equipment, software may be developed and programmed into the equipment by the manufacturer, and bought or leased by the user just as he buys or leases the equipment. Some users who have advanced programmers on their staffs develop their own software.

TRANSMISSION — The electronic transfer of data from one location (or device) to another.

THERMOCOUPLE — A thermoelectric temperature measuring device which develops a small voltage related to the temperature being measured.

THERMOELECTRIC — An electrical phenomenon related to temperature.

GENERAL INFORMATION

The Digistrip III may be used as a free-standing unit or, by means of its mounting flanges, it may be rack-mounted or installed in an instrument panel. Detailed instructions on mounting the unit are provided in the *Digistrip III User's Guide Supplement.*

To ensure the best possible operating reliability and accuracy, the unit should be installed in a clean, dust-free environment. The recommended ambient temperature range is 0-50°C (32-125°F), with a maximum relative humidity of 95% (non-condensing).

There are five general types of connections to the Digistrip III:

- AC power
- Analog input signals
- Serial input/output
- Alarm relay output
- Remote closures

AC POWER CONNECTION

The standard Digistrip III operates on 115 VAC, 60 Hz line power. Optionally, the unit may be set up to operate on 220/240 VAC, 50 Hz line power. The operating voltage requirement of each unit is shown on its serial number identification tag. To connect a Digistrip III to a power source, plug the female end of the power cord into the connector on the lower right corner of the unit's rear door (see Figure 2), and plug the male end into a properly grounded receptacle.

ANALOG INPUT CONNECTIONS

All analog inputs (voltages, thermocouples, etc.) are wired to screw terminals on the rear panel (see Figure 2). Each unit is equipped with three 16-channel input terminal banks, which are labelled *Bank 1, Bank 2* and *Bank 3.* Access to the terminal banks is gained by removing the rear panel cover.

When attaching analog input leads, route all wires from the hinged end of the rear door to the desired terminals. Voltage and thermocouple inputs should always be wired directly to the input screw terminals; process transmitter signals are handled by installing an appropriate shunt resistor across the input terminals. For the best measuring accuracy, the rear panel cover must be re-installed after input leads are attached.

SERIAL DATA CONNECTIONS

The unit is equipped with two groups of serial data connection terminals (see Figure 6). These terminals are used to communicate with computers, CRT displays, external scanners, etc. One group of terminals is marked CURRENT, and these terminals transmit and receive data via a 20 ma current loop. The other group is marked EIA. These conform to the Electronics Industry Association's RS232C specification, and transmit and receive data in that form. Baud (data) rates for serial data can be selected by jumpers on the Data Acquisition Board from 150 to 2400 baud and must be selected to conform to the baud rate requirements of the external device. When wiring an external device to the serial data terminals, be sure that all connections are made as indicated in Figure 6. Further details on serial data connections are provided in the *Digistrip III User's Guide Supplement.*

ALARM RELAY CONNECTIONS

The Digistrip III contains two internal Alarm Relays; these relays are designated as Even and Odd. The Alarm Relays are controlled by numbers assigned in conjunction with the Alarm Limits (see page 55). Connection terminals for the Alarm Relays are located on the rear panel (see Figure 6). When connected to external devices (indicator lamps, automatic shut-offs, etc.), the Alarm Relays may be wired for either normally open or normally closed operation.

REMOTE CLOSURE CONNECTIONS

A set of terminals labelled REMOTE CLOSURE is also located on the rear panel (see Figure 6). By briefly closing a normally open switch or relay which is wired to these terminals, a log (printout) may be initiated from a remote location.

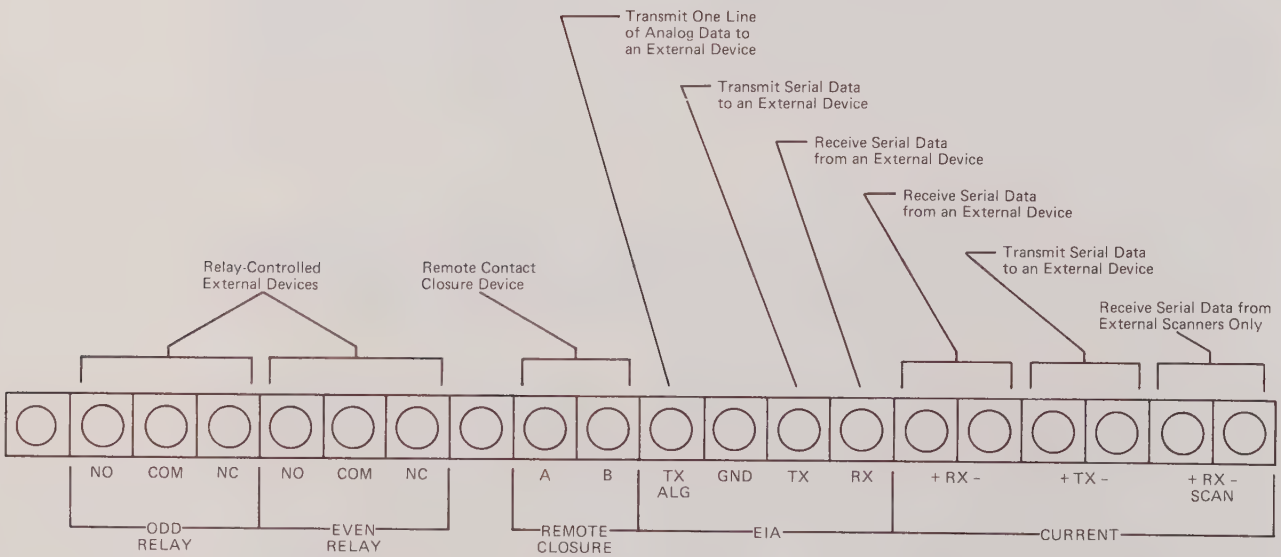

Transmit One Line of Analog Data to an External Device
Transmit Serial Data to an External Device
Receive Serial Data from an External Device
Receive Serial Data from an External Device
Transmit Serial Data to an External Device
Receive Serial Data from External Scanners Only
Relay-Controlled External Devices
Remote Contact Closure Device
NO COM NC NO COM NC
A B
TX ALG
GND TX RX
+ RX -
+ TX -
+ RX - SCAN
ODD RELAY
EVEN RELAY
REMOTE CLOSURE
EIA
CURRENT

FIGURE 6. CONNECTION TERMINALS

GENERAL INFORMATION

A Digistrip III has two primary modes of operation: PROGRAM mode and RUN mode. The PROGRAM mode is used only when programming the instrument; that is, when defining the operating parameters. At all other times the unit operates in the RUN mode. RUN mode operations include the collection of input data, calculations, alarm limits monitoring, data printout, etc.

In addition to normal RUN mode operations, the instrument can be set up to allow an operator to make changes in certain programmed information while operating in the RUN mode. These changes include alarm limits, time intervals, and input curve calibrations. The special Run Mode Programming operations are described on pages 72–81.

Once a Digistrip III has been installed and programmed, it is switched to RUN mode operation by setting the PROGRAM/RUN switch (see Figure 7) in the RUN position. While operating in the RUN mode, the instrument is controlled via the keyboard (see Figure 4).

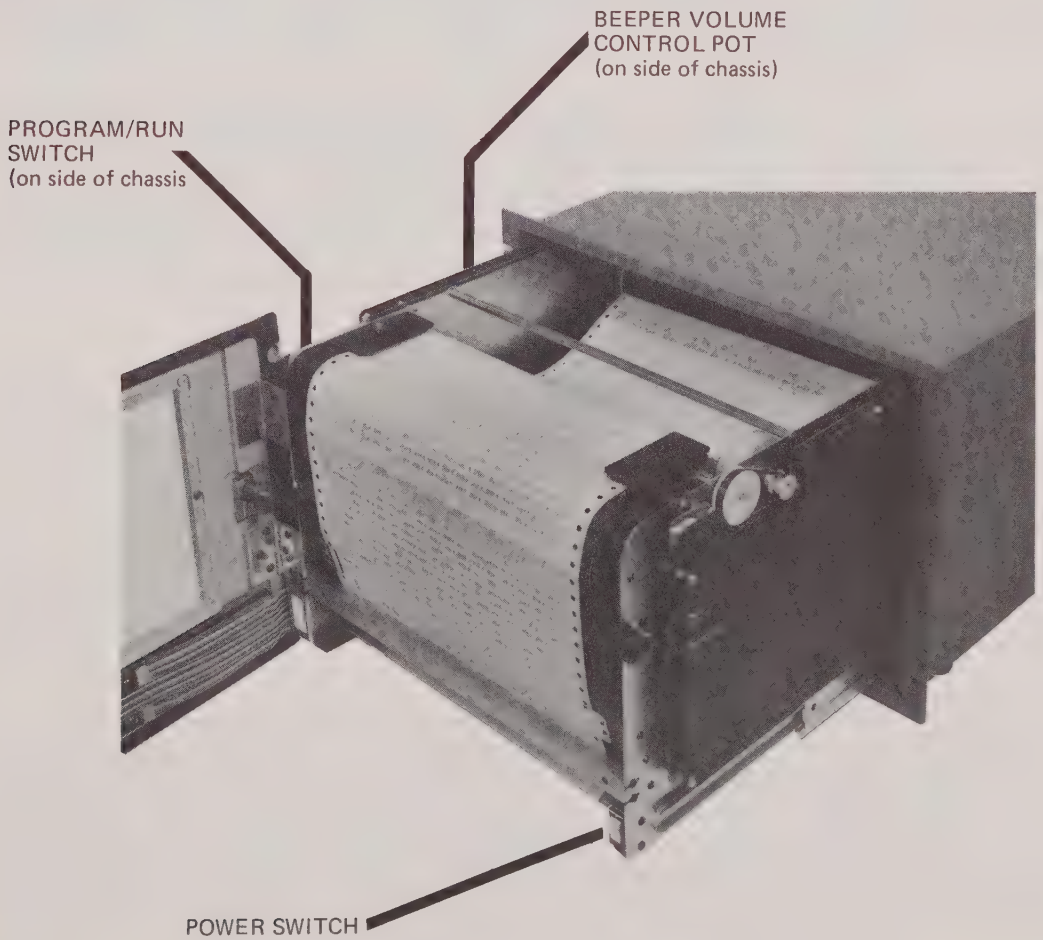


FIGURE 7. INTERNAL ASSEMBLY

RUN MODE OPERATION

The keyboard is divided into two sections. The left section has black keys; the right section has gray keys. During programming, all the keys are used. During RUN mode operation, only the black keys are normally used. By special configuration of the instrument, the gray keys may also be used during RUN mode operations, such as when the special Run Mode Programming feature is utilized.

Following are descriptions of the various RUN mode operations. Additional detailed information on these operations is provided in the *Digistrip III User's Guide Supplement.*

CHANNEL ADDRESSES

The Digistrip III contains 128 Channel Addresses. The Channel Addresses are arranged in an 8-row by 16-column matrix as shown in Figure 8 (opposite page). Each Channel Address is a 3-digit number. The first digit specifies the row in the matrix, and the last two digits specify the column. For example, Channel Address 103 is located in Row 100 and Column 03. The Channel Address is the identifying number, or "address," of a memory location.

In the Channel Address matrix shown in Figure 8, one of the locations has been enlarged to show visually what kind of information is typically stored in a memory location. During RUN mode operation, input data to a particular Channel Address is processed according to the instructions programmed for that location. Input data and operating instructions may be assigned to Channel Addresses in almost any order during programming. Outputs, however, are always printed in the matrix format shown.

RAMP/SCANNER INPUTS

One of the equipment options available for use with the Digistrip III is the Kaye RAMP/Scanner, which allows a Digistrip III to monitor up to 128 channels of analog input data. The RAMP/Scanner is available in two versions: 64-channel and 128-channel. Each unit is made up of a series of 8-channel plug-in modules.

Serial inputs from a RAMP/Scanner are assigned to Channel Addresses in consecutive order. As the system is set up, the transmission sequence always begins with RAMP/Scanner channel 000 being assigned to Channel Address 101. Figure 9 shows the RAMP/Scanner channel assignment scheme.

If direct inputs (for example, from thermocouples) are to be received as well as inputs from a RAMP/Scanner, care must be taken to ensure that only one input is assigned to each Channel Address. Scanner inputs to specific Channel Address lines may be omitted from the transmission sequence by disabling the appropriate 8-channel groups within the Scanner. For example, Scanner inputs to Line 100 may be omitted by disabling Channel Groups 000-007 and 008-015. Channel Addresses not used to receive RAMP/Scanner data may be used to process other inputs.

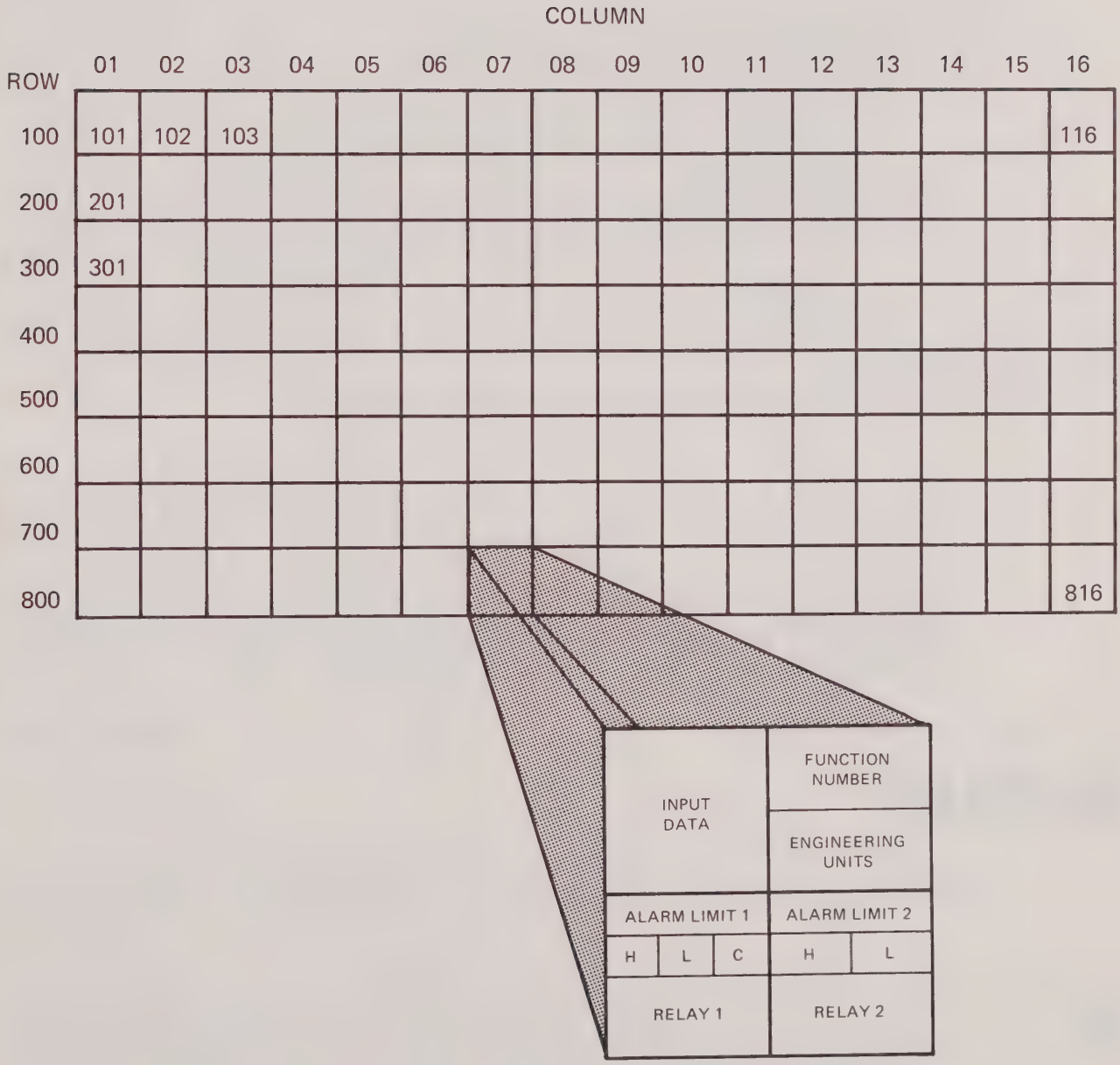


FIGURE 8. CHANNEL ADDRESS MATRIX

Line	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
100	Channels 000-007								Channels 008-015							
200	Channels 016-023								Channels 024-031							
300	Channels 032-039								Channels 040-047							
400	Channels 048-055								Channels 056-063							
500	Channels 100-107								Channels 108-115							
600	Channels 116-123								Channels 124-131							
700	Channels 132-139								Channels 140-147							
800	Channels 148-155								Channels 156-163							

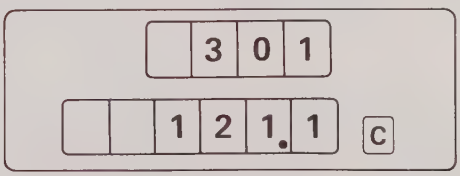
FIGURE 9. RAMP/SCANNER CHANNEL ASSIGNMENT

DATA DISPLAY

When an operator wants to inspect the current data value in a memory location, he calls up that location by keying its Channel Address on the keyboard. When a location is called up, its Channel Address number appears in the upper LED display (on the front panel), and its current data value appears in the lower display. At the same time, a Units character (if assigned) appears in the character display (see Figure 4). For example, a temperature value of 121.1°C in the memory location for Channel Address 301 would be called up via the keyboard and would appear in the display panel as follows:

When this sequence is keyed in the order shown . . .

. . . this display appears



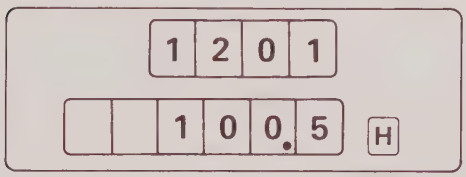
Once a particular memory location has been selected for display, adjacent locations may be displayed by using the Increment (→) or Decrement (←) key. By pressing either of these keys once, the data for the next higher (→) or lower (←) numbered memory location will be displayed. By pressing either key repeatedly, data for a series of adjacent memory locations will be displayed. When using these keys, memory locations are selected in a continuous sequence (that is, 101, 102, 103, etc., to 116; then 201, 202, etc.; or in reverse order). When the end of the Channel Address matrix is reached, the selection begins again with 101.

ALARM LIMITS DISPLAY

The programmed Alarm Limits in any memory location can be displayed by keying in a valid Channel Address and then pressing the LIMIT key. When an Alarm Limit is called up, the display panel will show the selected Channel Address as the three rightmost digits in the upper display, with the Alarm Limit number (1 or 2) as the leftmost digit in that display. At the same time, the value for that Limit will be shown in the lower display.

Whenever an Alarm Limit is displayed, a letter (H, L or C) will appear in the character display. This letter indicates the Limit type (High, Low or Rate-of-Change). The following example shows the keying squence and display of a high temperature Alarm Limit (Limit 1) of 100.5°C for Channel Address 201:

This display appears . . .



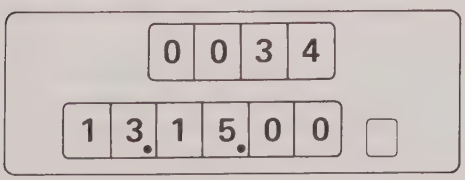
. . . when this sequence is keyed in the order shown

If the Channel Address selected for an Alarm Limit display is in an Alarm state, the display will automatically show the Limit violated. If both Limit 1 and Limit 2 are in an Alarm state, Limit 1 will be displayed first. If the Channel Address selected is not in an Alarm state, Limit 1 will be displayed. Pressing the LIMIT key a second time will cause the other Limit to be displayed.

TIME DISPLAY

The current time and day of the year can be displayed by pressing the TIME key. The day of the year will appear in the upper display, and the time (in hours, minutes and seconds) will appear in the lower display. For example, the display for 1:15 pm on February 3 (34th numerical day of year) would be as follows:

This display appears . . .



. . . by keying

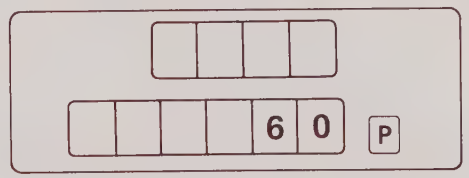
TIME INTERVAL DISPLAY

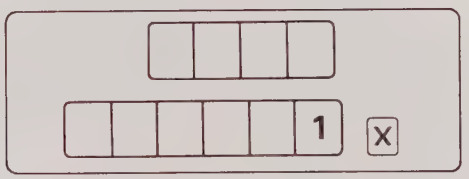
When programming a Digistrip III, either the same or different time periods may be defined for the Print Interval, External Transmission Interval, and Math Interval. These time intervals are expressed in minutes. Details of their usage are provided on pages 62 and 73.

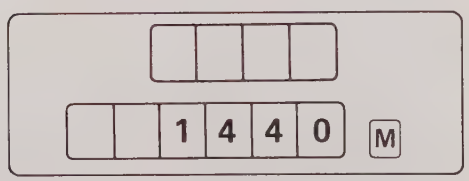
The TIME INTERVAL key is used to display the time period defined for a particular time interval. It also causes the letter P, X or M to appear in the character display, which specifies whether a Print Interval, External Transmission Interval, or Math Interval is being displayed. Pressing the TIME INTERVAL key once results in the display of the Print Interval (P). Pressing it a second time causes the External Transmission Interval (X) to be displayed. Pressing it a third time displays the Math Interval (M).

The following example shows the keying sequence and displays involved in reviewing a defined Print Interval of 60 minutes, an External Transmission Interval of 1 minute, and a Math Interval of 1440 minutes (24 hours).

By keying . . . **. . . these displays appear**



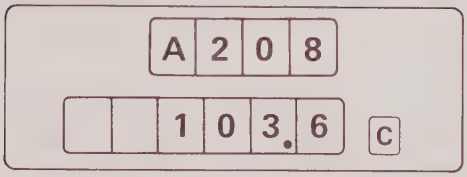




ALARM SEARCH

The ALARM SEARCH key is used whenever alarms are to be monitored. There are two types or modes of Alarm Search: Manual Search and Auto Search. The ALARM SEARCH key is used for both modes (see description in following paragraphs). In either mode, the Channel Addresses in an alarm state will appear in the upper display (to the right), with the letter A at the left (indicating Alarm). As each alarmed Channel Address is displayed, that location's data will be shown in the lower display. If a Units characters has been assigned, it will appear in the character display. The following example shows the display of a temperature of 103.6°C which is violating the Alarm Limit for Channel Address 208.

This display appears . . .



. . . by keying

By pressing the ALARM SEARCH key once, the Manual Search mode is selected. Each time the ALARM SEARCH key is pressed, the display will show the next Channel Address that is in Alarm. By repeatedly pressing the key, every alarmed Channel Address may be inspected in turn by the operator. If no Channel Address is in Alarm, then pressing the ALARM SEARCH key does not change the selected Channel Address.

The Auto Search mode is selected or deleted by pressing the ALARM SEARCH key twice in rapid succession. When this mode is selected, the Auto Search indicator will light, and any Channel Address which enters an alarm state will be displayed automatically. If more than one Channel Address is in Alarm, the display will show each alarmed Channel Address, together with its alarm data value, on a revolving basis at 1-second intervals.

Whenever any Channel Address enters Alarm, the System Alarm indicator will light, and the beeper will sound once each second. Pressing any key will silence the beeper. The System Alarm indicator, however, will remain lit as long as any Channel Address in the system remains in Alarm.

LOG AND AUTO LOG OPERATION

Operation of the internal printer is controlled by the LOG and ALARM LOG keys. A Log of current data values can be printed out at any time by pressing the LOG key once. Figure 10 shows a sample Log printout.

Pressing the LOG key twice in rapid succession will enable or delete the Auto Log operation. Auto Log operation causes printouts of current data values to be made automatically at the defined Log Interval. If a particular Digistrip III is programmed for Secured Auto Log operation (that is, if digit 5 of Configuration Number 1 is defined as 2, 3, 6 or 7), the Auto Log feature cannot be deleted via the keyboard.

```
12:46:50 632.5C 416.0C 408.2C 412.1C 413.4C 412.1C 412.1C 410.8C 417.3C 437.1  408.2  103   28.9  1490  0.00
200      0.770W 0.05M  33.0C  32.7C  1.8P   31.8C  33.1C  7.2P   1.9P   16.5    6.2P  3.787K 2.32K 33.2C 33.1C 0.24M

12:47:30 632.5C 414.7C 406.9C 412.1C 412.1C 412.1C 410.8C 410.8C 416.0C 436.4  406.9  103   29.5  1475  0.00
200      0.760W 0.06M  32.9C  32.7C  1.8P   31.8C  33.0C  7.2P   1.9P   16.6    7.3P  3.737K 2.73K 33.2C 33.0C 0.24M

12:47:50 632.5C 414.7C 406.9C 410.8C 412.1C 410.8C 410.8C 410.8C 416.0C 436.1  406.9  103   29.2  1460  0.00
200      0.757W 0.06M  32.9C  32.6C  1.8P   31.7C  33.0C  7.1P   1.9P   16.5    7.6P  3.687K 2.94K 33.1C 32.9C 0.24M

12:52:00 632.5C 399.1C 378.3C 395.2C 391.3C 386.1C 396.5C 387.4C 400.4C 418.5  378.3  103   40.2  1055  0.00
200      0.585W 0.06M  30.1C  29.8C  1.2P   30.7C  30.9C  4.5P   1.3P   11.2    8.3P  2.237K 3.10K 30.4C 30.1C 0.19M
```

FIGURE 10. SAMPLE LOG PRINTOUT

ALARM LOG OPERATION

The Alarm Log feature allows the Digistrip III to print out alarm information whenever an Alarm Limit is exceeded. This printout may be in the form of either (1) data values, with alarm conditions indicated, or (2) an alarm message.

Figure 11 shows a sample alarm data printout. The printout contains the time and the current data values for all Channel Addresses configured for printing. The letter A appears immediately to the right of the time field, and an asterisk (*) is shown immediately to the right of each alarmed data value (note the next to the last line of the sample in Figure 11). Following an Alarm Log, the asterisk will continue to be printed each time the alarmed data value is printed.

```
16:32:20   25.0C  104.6C  103.9C  104.4C  104.4C  104.3C  104.4C  104.2C
200       -2.458W   0.00M  119.4C  119.1C    0.1P  104.6C  127.3C  -24.6P

16:32:40   25.0C  105.0C  104.5C  104.8C  104.8C  104.8C  104.8C  104.7C
200       -2.458W   0.00M  119.9C  119.7C    0.1P  105.0C  127.9C  -24.6P

16:32:52A  25.0C  105.1C  104.7C  105.0C  105.0C* 105.0C  105.0C  104.9C
200       -2.458W   0.00M  120.1C  120.0C    0.1P  105.1C  128.1C  -24.6P
```

FIGURE 11. SAMPLE ALARM DATA PRINTOUT

Figure 12 shows a sample alarm message printout. This printout contains the time, location of the alarm condition, alarmed data value, relay number assigned, and alarm message.

```
13:35:42 216   2.18   11 VIBRATION TRIP-STEAM TURBINE
13:35:48 205   16.0    8 CHECK GENERATOR AXIAL PLAY
13:35:53 114 15440     9 TURBINE OVERSPEED ALERT
13:36:00 114 16345    10 TURBINE OVERSPEED-SHUT DOWN NOW
```

FIGURE 12. SAMPLE ALARM MESSAGE PRINTOUT

The Alarm Log feature is enabled or deleted by pressing the ALARM LOG key twice in rapid succession. If the Digistrip III is programmed for Secured Alarm Log operation (that is, if digit 5 of Configuration Number 1 is defined as 1, 3, 5 or 7), the Alarm Log feature cannot be deleted via the keyboard. The Alarm Log feature operates independently from the Auto Log feature; because of this, Alarm Log printouts do not disturb the Auto Log timer.

POWER ON PRINTOUTS

Whenever the power switch (see Figure 7) is turned ON, or power is returned following an interruption, the printer automatically prints a "Power Off" message. This message lists the day and time at which the power interruption occurred. In addition, the message includes a 4-digit diagnostic code. A code of 0000 indicates a normal shutdown or external power interruption. A code other than 0000 indicates an internal problem. For interpretation of this diagonostic code, refer to the *Digistrip III User's Guide Supplement.*

An internally recharged NiCd battery pack sustains the instrument's CMOS memory and realtime clock for a period of several weeks following a power interruption. The unit's ability to retain "Power Off" message information is limited by the battery discharge rate.

Following the printing of a "Power Off" message, the unit prints a new top-of-page header and a current data log.

BEEPER

The Digistrip III is equipped with an audible beeper, which is located behind the slotted grill on the front door panel (see Figure 1). Whenever the keyboard is being used, the beeper functions as a "prompter" for the operator. When a valid (correct) keying entry is made, the beeper sounds a short beep tone. When an invalid (incorrect) entry is attempted, a long steady tone is heard and the entry is rejected.

During RUN mode operation, the beeper is also used to announce alarm conditions. Whenever an alarm condition develops on any input, the beeper sounds a pulsating alarm tone. This tone may be silenced by pressing any active key.

The volume level of the beeper is adjustable. It may be increased or decreased by turning the beeper volume control POT (see Figure 7).

INDICATOR LAMPS

There are seven indicator lamps on the front panel (see Figure 4). When lighted, these lamps indicate the following special operating conditions:

Auto Search — Instrument operating in Auto Search mode.

Alarm Log — Instrument operating in Alarm Log mode.

Auto Log — Instrument operating in Auto Log mode.

System Alarm — One or more inputs exceeding an Alarm Limit.

Off Line — Instrument not monitoring input data. This may be because the printer is set in the LOAD mode, or because the instrument is set in the PROGRAM mode.

Open Circuit — Open circuit input on Channel Address displayed.

Over Range — Over range input on Channel Address displayed.

PAPER LOADING (Refer to Figure 13.)

The printer uses 8½x11 inch fanfold paper with tear-off guide strips. The paper is supplied in 150-page stacks, with 10 stacks per case. A paper stack may be loaded into the printer while the instrument is set in either the PROGRAM or RUN mode. Using Figure 13 as a guide, load paper as follows:

1. Unlatch and open the front door and slide the chassis forward on its rails.

NOTE

When Digistrip III is installed as a free-standing unit on a bench top: If, when the chassis is pulled forward, it is "hanging" in midair, precautions should be taken to brace the front edge of the chassis so its weight will not tip the entire unit.

2. With the power switch (A) ON and the LOAD/RUN switch (B) in the RUN position, tear off and remove any unused paper from the lower tray (D). Then depress the PAPER FEED swtich (C) to advance the last printed page out of the printer.

3. Deactivate the printer by setting the LOAD/RUN switch (B) to the LOAD position.

4. Remove the printed pages from the upper paper tray (J).

5. Slide a new paper stack into the lower tray (D). Make sure that the legend *Kaye Instruments, Inc.* is on the right, and that the Out-of-Paper red stripe is on the bottom.

6. Feed three sheets of paper upward behind the platen (E). Guide the paper under the paper clips (F), over the top of the paper guide (G), through the tractor drive guides (H), under the upper guide bar (I), and into the upper tray (J).

NOTE

Make sure that the pages fold into the upper tray in the same alternating manner and direction as they did in the original stack. This will ensure that the printed pages will feed properly into the tray.

7. Once the new paper stack is correctly loaded, adjust the page position so that the headers will automatically be printed at the top of each page. To make this adjustment, depress the PAPER FEED switch (C) while the LOAD/RUN switch (B) remains in the LOAD position. This will cause the paper to advance continually until the switch is released. Hold the switch down until the paper is positioned with the perforations just above the edge of the platen (E). Once the paper is properly positioned, return the LOAD/RUN switch (B) to the RUN position; this will enter the top-of-the-page position into the memory.

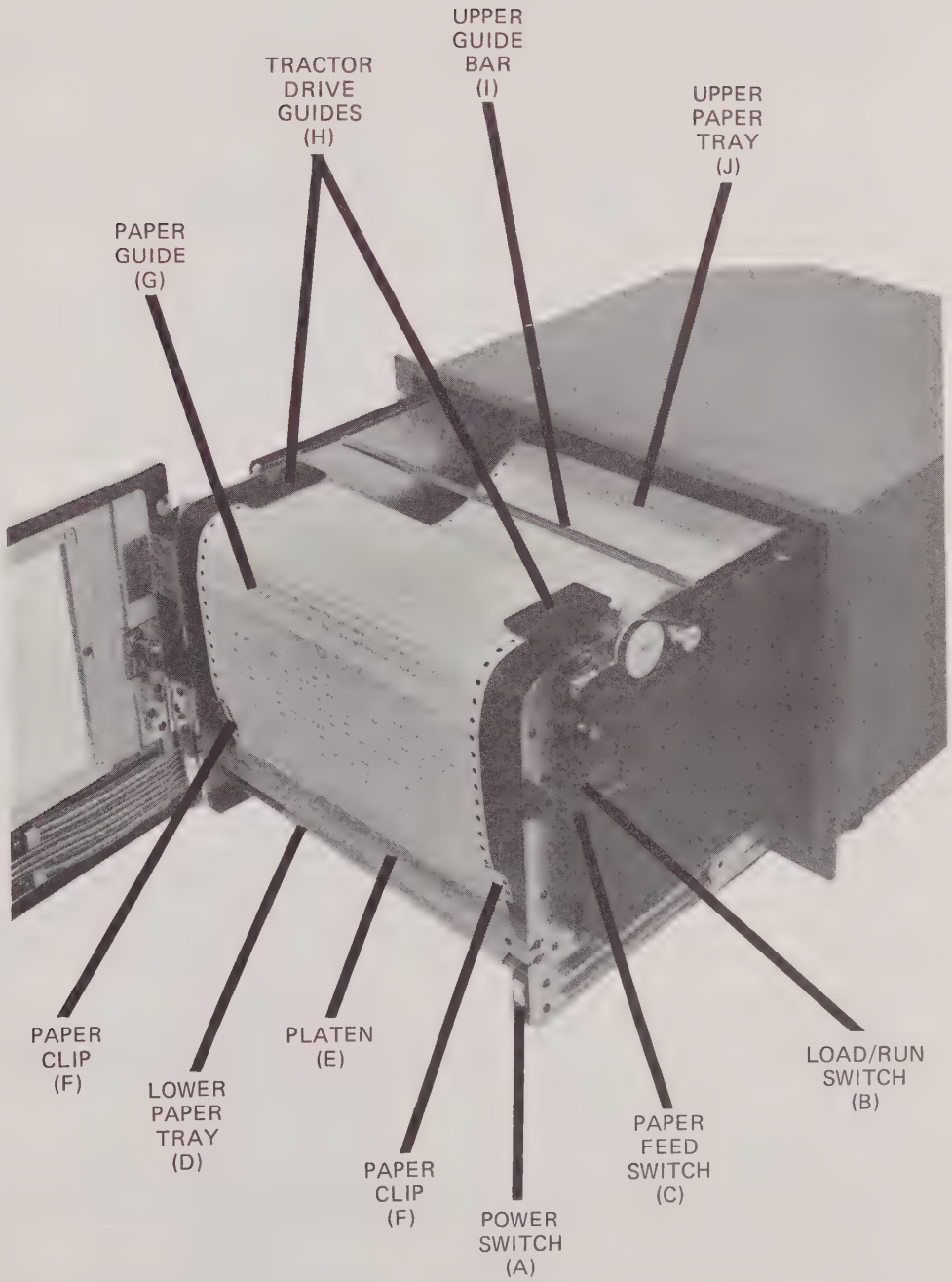


FIGURE 13. PAPER LOADING

GENERAL INFORMATION

Programming means defining, for a computer, the procedures to be used in collecting, processing and displaying data. The Digistrip III's microprocessor is programmed by a combination of keyboard and internal switch-setting procedures.

When the instrument is operating in the PROGRAM mode, the entire keyboard is active. In this mode, most of the keys have dual functions. Each dual function key has a number, symbol or operation description printed in its center. In addition, it has a letter, symbol or operation printed in its upper right corner (see Figure 4).

There are two types of keyboard operation: normal (non-shifted) and shifted. Most programming entries are made with the keyboard in the normal mode. In this mode, each keystroke defines the number, symbol or operation printed in the center of the key. However, both normal and shifted modes are used when programming Headers, Alarm Messages, Serial Transmission Start and End Messages, and Engineering Units. In the shifted mode, each keystroke defines the letter, symbol or operation shown in the upper right corner of the key.

When both normal and shifted modes are being used, the underline (_) and hyphen (-) symbols, respectively, are used to indicate that either the normal or shifted mode is in use. These mode-indicating symbols appear in the leftmost charcter position of the lower LED display.

The shifted keyboard mode is accessed by pressing the ALPHA SHIFT key one time. When operating in the shifted mode, the keys program the information printed in their upper right corners. Once the shifted mode is selected, the instrument remains in this mode until a new memory location is accessed, or until the ALPHA SHIFT key is pressed a second time.

When identical information is to be programmed into a series of consecutive information storage locations (i.e., Channel Addresses, header fields, or channel function registers), the programming procedure may be simplified by use of either the Increment (→) or Decrement (←) key or the ADVANCE key. Pressing the Increment or Decrement key changes the accessed information storage location incrementally. Whenever one of these keys is pressed, the newly accessed location will be shown in the upper LED display. At the same time, the information presently stored in this new location will appear in the lower display.

Pressing the ADVANCE key also changes the information storage location incrementally. Whenever this key is pressed, the information stored in the previously accessed location is transferred to the display of the new location. This transferred information may be programmed into the new location by pressing the ENTER key.

All units shipped from the manufacturer contain a simple test program. During setup, this program should be used to check out the instrument for proper operation. Once the unit is checked out, it is ready for initialization and programming by the operator.

Figures 14 through 17 show blank programming forms. Such forms should be filled out when a new program is planned. After mapping out the desired program on paper, the operator should proceed to initialize and program the instrument as described in this section.

DIGISTRIP III PROGRAMMING FORM

HEADERS, FUNCTIONS, CONFIGURATION NUMBERS AND TIME INTERVALS

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
HEADER 900																
HEADER 100																
HEADER 200																
HEADER 300																
HEADER 400																
HEADER 500																
HEADER 600																
HEADER 700																
HEADER 800																
FUNCTION																
100																
200																
300																
400																
500																
600																
700																
800																

CONFIGURATION NUMBERS

CONFIGURATION NUMBER 1						
CONFIGURATION NUMBER 2						
CONFIGURATION NUMBER 3						
CONFIGURATION NUMBER 4						

TIME INTERVALS (MINUTES)

PRINT INTERVAL (P) _____

EXTERNAL TRANSMISSION INTERVAL (X) _____

MATH INTERVAL (M) _____

FIGURE 14. DIGISTRIP III PROGRAMMING FORM — Headers, Functions, Configuration Numbers and Time Intervals

USER-DEFINABLE LINEAR FUNCTIONS

FUNCTION NO.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
INPUT 1																
INPUT 2																
OUTPUT 1																
OUTPUT 2																
UNITS ID																

FUNCTION NO.	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
INPUT 1																
INPUT 2																
OUTPUT 1																
OUTPUT 2																
UNITS ID																

USER-DEFINABLE ACCUMULATION FUNCTIONS

FUNCTION NO.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
ACCUM INTERVAL																
INPUT 1																
OUTPUT 1																
UNITS ID																

*INPUT 2																
*OUTPUT 2																

**Input 2 and Output 2 values are never defined for Accumulation Functions. Values may be assigned to these memory locations, however, in conjunction with Functions 96, 97 and 98.*

FIGURE 15. DIGISTRIP III PROGRAMMING FORM — Function Parameters

DIGISTRIP III PROGRAMMING FORM

LIMITS AND RELAYS

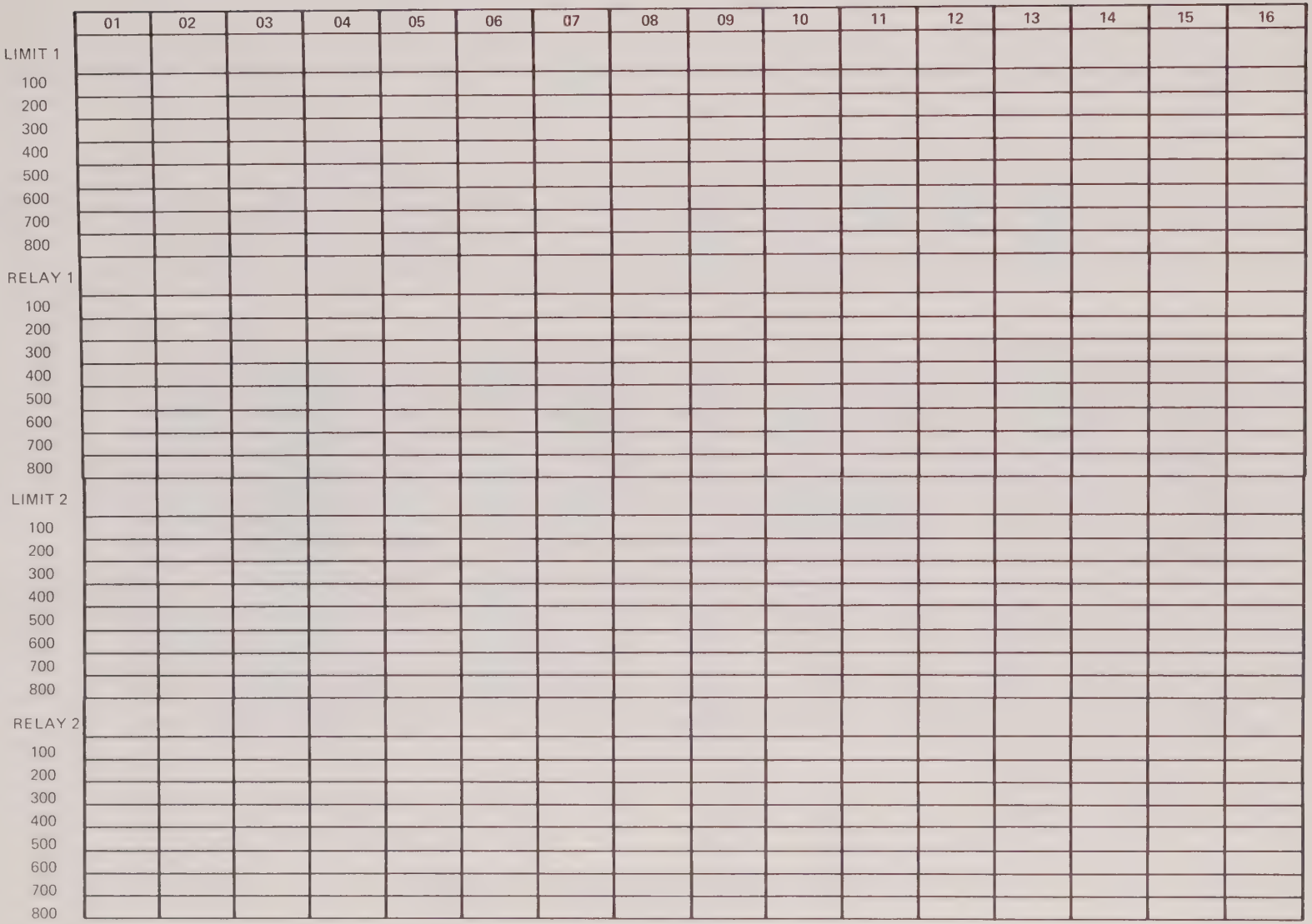


FIGURE 16. DIGISTRIP III PROGRAMMING FORM — Limits and Relays

DIGISTRIP III PROGRAMMING FORM

ALARM MESSAGES AND SERIAL TRANSMISSION START AND END MESSAGES

ALARM MESSAGES

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
LINE 100	RELAY 01 MESSAGE				RELAY 02 MESSAGE				RELAY 03 MESSAGE				RELAY 04 MESSAGE			
LINE 200	RELAY 05 MESSAGE				RELAY 06 MESSAGE				RELAY 07 MESSAGE				RELAY 08 MESSAGE			
LINE 300	RELAY 09 MESSAGE				RELAY 10 MESSAGE				RELAY 11 MESSAGE				RELAY 12 MESSAGE			
LINE 400	RELAY 13 MESSAGE				RELAY 14 MESSAGE				RELAY 15 MESSAGE				RELAY 16 MESSAGE			
LINE 500	RELAY 17 MESSAGE				RELAY 18 MESSAGE				RELAY 19 MESSAGE				RELAY 20 MESSAGE			
LINE 600	RELAY 21 MESSAGE				RELAY 22 MESSAGE				RELAY 23 MESSAGE				RELAY 24 MESSAGE			
LINE 700	RELAY 25 MESSAGE				RELAY 26 MESSAGE				RELAY 27 MESSAGE				RELAY 28 MESSAGE			
LINE 800	RELAY 29 MESSAGE				RELAY 30 MESSAGE				RELAY 31 MESSAGE				RELAY 32 MESSAGE			

SERIAL TRANSMISSION START AND END MESSAGES

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
ASCII CHARACTER LINE 900	START MESSAGE								END MESSAGE							

FIGURE 17. DIGISTRIP III PROGRAMMING FORM — Alarm Messages and Serial Transmission Start and End Messages

INITIALIZATION

Initialization is the procedure used to clear the memory of unwanted program information. The initialization procedure must always be carried out prior to entering a new program.

To initialize a Digistrip III, start with the power switch ON and the PROGRAM/RUN switch set in the RUN position (see Figure 7). Next, move the PROGRAM/RUN switch rapidly through a down-up-down (PROGRAM-RUN-PROGRAM) switching sequence. Do this *ONLY ONCE.* At the end of this switching sequence, the PROGRAM/RUN switch will be in the PROGRAM position, and the instrument's memory will be cleared and ready for programming.

CONFIGURATION NUMBERS

One of the steps involved in programming a Digistrip III requires the definition of certain basic operating instructions for the microprocessor. These instructions are defined by assigning a series of four separate 6-digit Configuration Numbers (Configuration Numbers 1, 2, 3 and 4). The Configuration Numbers define system operations only; they do not provide operating instructions for individual Channel Addresses. Included in the Configuration Number instructions is such information as which lines are to be printed, which temperature scale (Celsius or Fahrenheit) is to be used, and how the alarm relays are to operate.

The 6 digits of each Configuration Number are selected by the programmer from the options described in the appropriate Configuration Number Selection Table (see Tables 1, 2, 3 and 4). Once the digits of a particular Configuration Number are selected, that number may be programmed via the keyboard. The normal procedure used for programming is to assign Configuration Number 1 first, followed successively by Numbers 2, 3 and 4. Each of the four Configuration Numbers must be defined before the instrument will operate properly in the RUN mode.

To access Configuration Number 1's memory location for programming, press the CONFIG NUMBER key one time. This brings up a "1" in the upper LED display and six zeros in the lower display, indicating that Configuration Number 1's memory location is accessed and that there are six digits to be programmed. (If a value has already been programmed for Configuration Number 1, that number will appear in the lower display rather than the six zeros.) Once the memory location is accessed for programming, the 6-digit number selected for Configuration Number 1 is defined by pressing the appropriate number keys in correct sequence, followed by pressing the ENTER key.

The following example demonstrates the selection and entry of a typical Configuration Number 1 operating routine.

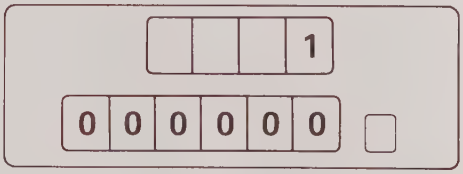
EXAMPLE

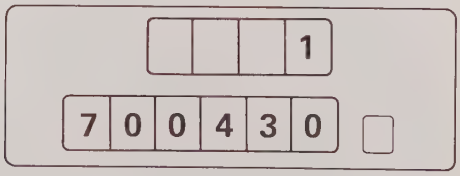
A programmer wishes to define Configuration Number 1 such that the instrument will do the following:

- Print Lines 100, 200 and 300 only.
- Print one blank line after each Log.
- Express temperatures in ^{o}C.
- Operate with the Auto Log, Alarm Log and Print Interval secured against unauthorized changes.

Using the information contained in Table 1, Configuration Number 1 is defined as 700430. The following shows the keying sequence and displays involved in programming this number.

By keying these sequences in the order shown . . . **. . . these displays will appear**





Once Configuration Number 1 has been selected and entered into the memory, Configuration Number 2 may be programmed. To access Configuration Number 2's memory location, press the CONFIG NUMBER key a second time. Then, using Table 2 and the programming procedures described above, proceed to program Configuration Number 2. Following this, Configuration Numbers 3 and 4 may be programmed in a similar manner using Table 3 and 4, respectively.

TABLE 1. CONFIGURATION NUMBER 1 SELECTION GUIDE

(● indicates features selected)

DIGIT 1								
0	1	2	3	4	5	6	7	
				●	●	●	●	Print Group 100
		●	●			●	●	Print Group 200
	●		●		●		●	Print Group 300
●								None of the Above

DIGIT 2								
0	1	2	3	4	5	6	7	
				●	●	●	●	Print Group 400
		●	●			●	●	Print Group 500
	●		●		●		●	Print Group 600
●								None of the Above

DIGIT 3								
0	1	2	3	4	5	6	7	
				●	●	●	●	Print Group 700
		●	●			●	●	Print Group 800
	●		●		●		●	Print Relay Numbers
●								None of the Above

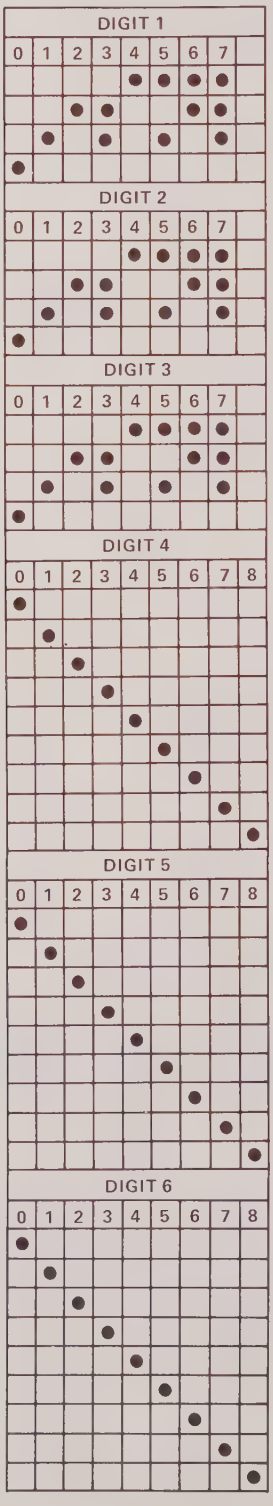
DIGIT 4								
0	1	2	3	4	5	6	7	
				●	●	●	●	Print One Blank Line After Each Log
		●	●			●	●	Print Two Extra Blank Lines Between Pages
	●		●		●		●	Print Five Extra Blank Lines Between Pages
●								None of the Above

DIGIT 5								
0	1	2	3	4	5	6	7	
				●	●	●	●	Temperature in °F
●	●	●	●					Temperature in °C
		●	●			●	●	Secure Auto Log and Print Interval against Change during Run Mode
	●		●		●		●	Secure Alarm Log against Change during Run Mode

DIGIT 6								
0	1	2	3	4	5	6	7	
				●	●	●	●	Enable Run Mode Redefinition of External Transmission and Math Intervals
		●	●			●	●	Enable Run Mode Redefinition of Alarm Limits
	●		●		●		●	Enable Run Mode Automatic Calibration Feature
●								None of the Above

TABLE 2. CONFIGURATION NUMBER 2 SELECTION GUIDE

(● indicates features selected)



Print Header 100
Print Header 200
Print Header 300
None of the Above

Print Header 400
Print Header 500
Print Header 600
None of the Above

Print Header 700
Print Header 800
Print External Line of Text
None of the Above

Input Terminal Bank 1 Inoperative
Assign Terminal Bank 1 Input to Line 100
Assign Terminal Bank 1 Input to Line 200
Assign Terminal Bank 1 Input to Line 300
Assign Terminal Bank 1 Input to Line 400
Assign Terminal Bank 1 Input to Line 500
Assign Terminal Bank 1 Input to Line 600
Assign Terminal Bank 1 Input to Line 700
Assign Terminal Bank 1 Input to Line 800

Input Terminal Bank 2 Inoperative
Assign Terminal Bank 2 Input to Line 100
Assign Terminal Bank 2 Input to Line 200
Assign Terminal Bank 2 Input to Line 300
Assign Terminal Bank 2 Input to Line 400
Assign Terminal Bank 2 Input to Line 500
Assign Terminal Bank 2 Input to Line 600
Assign Terminal Bank 2 Input to Line 700
Assign Terminal Bank 2 Input to Line 800

Input Terminal Bank 3 Inoperative
Assign Terminal Bank 3 Input to Line 100
Assign Terminal Bank 3 Input to Line 200
Assign Terminal Bank 3 Input to Line 300
Assign Terminal Bank 3 Input to Line 400
Assign Terminal Bank 3 Input to Line 500
Assign Terminal Bank 3 Input to Line 600
Assign Terminal Bank 3 Input to Line 700
Assign Terminal Bank 3 Input to Line 800

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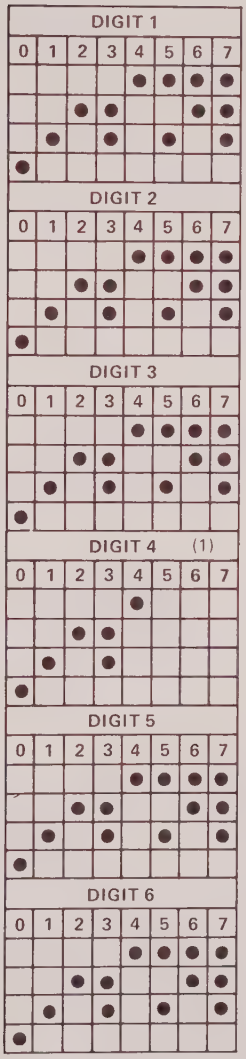
TABLE 3. CONFIGURATION NUMBER 3 SELECTION GUIDE

(● indicates features selected)



Transmit Group 100 in Serial Data	6
Transmit Group 200 in Serial Data	
Transmit Group 300 in Serial Data	
None of the Above	
Transmit Group 400 in Serial Data	
Transmit Group 500 in Serial Data	6
Transmit Group 600 in Serial Data	
None of the Above	
Transmit Group 700 in Serial Data	
Transmit Group 800 in Serial Data	
Transmit Relay Numbers in Serial Data	6
None of the Above	
Transmit Serial Data Identical to Printout	0
Transmit Channel Numbers with Serial Data	
Transmit Time with Serial Data	
None of the Above	
Transmit Auto Log at Serial Time Interval	6
Transmit Data at Alarm Occurence	
Transmit Data at Accumulation Function Timeout	
None of the Above	
Transmit Eight Channels per Line (2)	
Disable Right Half of Keyboard in Run Mode	
Enable Single Line Transmission by Remote Synchronization (3)	0
None of the Above	

NOTES:

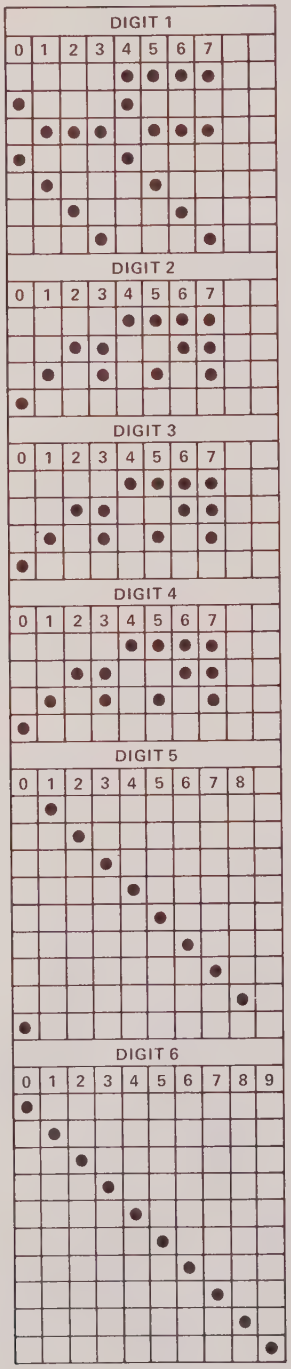
(1) Digit 4 must be 4 or less. If Digit 4 is equal to 4, Digits 5 and 6 must be 0.

(2) When not transmitting 8 channels per line, one channel per line will be transmitted if channel numbers are transmitted, and 16 channels per line if channel numbers are not transmitted.

(3) When this feature is enabled, the next line of data will be transmitted each time a DC3 character is received. This feature will not operate properly if the system is programmed to transmit 8 channels per line with channel numbers.

TABLE 4. CONFIGURATION NUMBER 4 SELECTION GUIDE

(● indicates features selected)



Relays Normally Energized (de-energized on alarm)
Even Relay Static Closure on Even Relay Number Trip
Even Relay Static Closure on Any Relay Number Trip
Odd Relay Static Closure on Odd Relay Number Trip
Odd Relay Static Closure on Odd Relay Number Trip
Odd Relay Pulse on Any Relay Number Entering Alarm
Odd Relay Pulse on Any Relay Entering or Exiting Alarm
Odd Relay Pulse Once Each Minute

Enable Remote Scanner Serial Input
Enable Program Offload Feature
Interpret Serial Input DC2 Same as Contact Closure
None of the Above

Enable Printout by Contact Closure or DC2 Input
Enable Transmission by Contact Closure or DC2 Input
Enable Timer Resets by Contact Closure or DC2 Input
None of the Above

Print Data at Accumulation Function Timeout
Reset Timers at Next Hour After Power On*
Print Single Alarm Message
None of the Above

Transmit Line 100 Continuously
Transmit Line 200 Continuously
Transmit Line 300 Continuously
Transmit Line 400 Continuously
Transmit Line 500 Continuously
Transmit Line 600 Continuously
Transmit Line 700 Continuously
Transmit Line 800 Continuously
None of the Above

NOTE: For transmission to Analog Output Module ONLY.

Assign 10 Count Hysteresis for Alarm Limit Reset
Assign 1 Count Hysteresis for Alarm Limit Reset
Assign 2 Count Hysteresis for Alarm Limit Reset
Assign 3 Count Hysteresis for Alarm Limit Reset
Assign 4 Count Hysteresis for Alarm Limit Reset
Assign 5 Count Hysteresis for Alarm Limit Reset
Assign 6 Count Hysteresis for Alarm Limit Reset
Assign 7 Count Hysteresis for Alarm Limit Reset
Assign 8 Count Hysteresis for Alarm Limit Reset
Assign 9 Count Hysteresis for Alarm Limit Reset

*Otherwise the timers will be reset at midnight after Power On. Manually resetting timers eliminates either automatic reset.

CHANNEL FUNCTIONS

The Digistrip III can accept input data from a variety of devices such as thermocouples, pressure transducers and current transmitters. Each input must be assigned to a specific Channel Address. In order for the instrument to process an input, a specific computation routine must be defined. These routines are called Channel Functions. Table 5 provides detailed information on the Digistrip III Channel Functions.

Whenever a Channel Function is assigned to a Channel Address, it must be defined as a 5-digit number. The first part of this number is a 2-digit Function Code which defines the computation routine. The last part is a 3-digit Source Code which specifies the Channel Address from which the input data is to be taken.

TABLE 5. CHANNEL FUNCTIONS

Function Number	Operation	Decimal Position	Location of Input Data
00	Skip		
01	Display 65.000 mv	XX.XXX	Same as channel to which function is assigned; Source Code always 000.
02	Display 650.00 mv	XXX.XX	
03	Display 6500.0 mv (6.5 V)	XXXX.X	
04	Type E Thermocouple	XXXX.X	If Source Code is 000, input location is same as channel to which function is assigned. If Source Code is 101-816, reference value at specified location is added to the input value of the channel to which the function is assigned, before the thermocouple conversion is performed.
05	Type J Thermocouple	XXXX.X	
06	Type K Thermocouple	XXXX.X	
07	Type R Thermocouple	XXXX.X	
08	Type S Thermocouple	XXXX.X	
09	Type T Thermocouple	XXXX.X	
10	100 ohm Pt RTD (1 ma source)	XXXX.X	Same as Functions 01-03.
11	100 ohm Pt RTD (Bridge)	XXXX.X	Same as Functions 01-03.
12	Type T Thermocouple (0.01 C)	XXX.XX	Same as Functions 04-09
13	Special Calibration (32 mv)	X.XXXX	Same as Functions 01-03.
14-45	User-Definable Linearizations	User-Defined	If Source Code is 000, input location is same as channel to which function is assigned. If Source Code is 101-816, input is from specified location.
46-61	User-Definable Accumulations	User-Defined	If Source Code is 000, input is from channel next above in same column. If Source Code is 101-816, input is from the specified location.
62	Interval Average	As Source	
63	Interval Maximum	As Source	
64	Interval Minimum	As Source	
65	Change per Minute	As Source	
66	Group Average	As Source	See Function Description.
67	Group Maximum	As Source	See Function Description.
68	Group Minimum	As Source	See Function Description.

(continued)

TABLE 5. CHANNEL FUNCTIONS (continued)

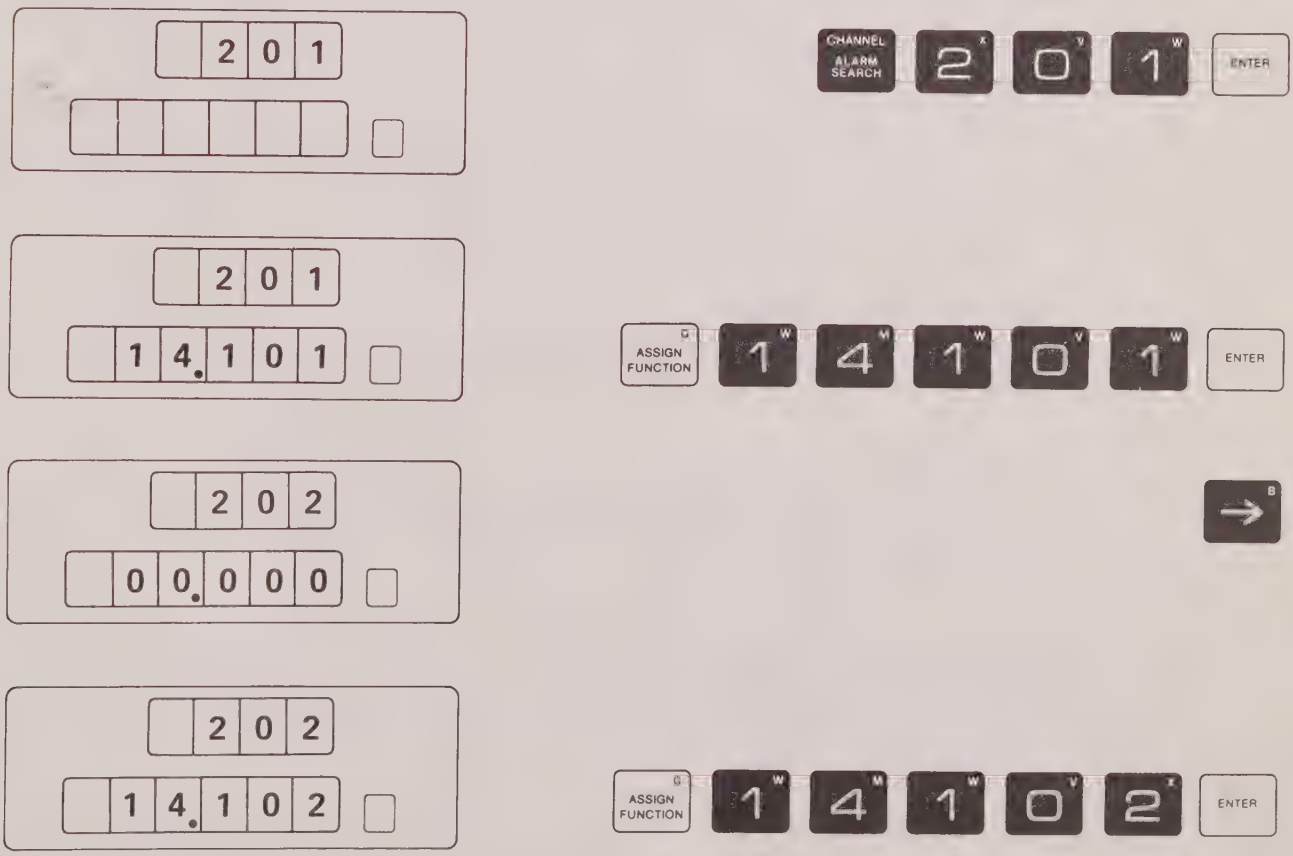
Function Number	Operation	Decimal Position	Location of Input Data
69	Math Interval Transfer	As Source	Same as Functions 46-65.
70	Normal Transfer	As Source	Same as Functions 46-65.
71	Square Root	Floating	If Source Code is 000, input is from channel next above in same column. If Source Code is 101-816, input is from the specified location.
72	Natural Log	Floating	
73	Exponential	Floating	
74	Sine	X.XXXX	
75	Cosine	X.XXXX	
76	Tangent	Floating	
77	Inverse Sine	X.XXXX	
78	Inverse Cosine	X.XXXX	
79	Inverse Tangent	X.XXXX	
80	Addition (X + Y)	As Y Input	For *even* function numbers, Y is always the channel next to the left in the same line. For *odd* function numbers, Y is always the channel next above in the same column. If the Source Code is 000, X is the next channel in the line beyond Y. If the Source Code is 101-816, X is at the specified location.
81	Addition (X + Y)	As Y Input	
82	Subtraction (X − Y)	As Y Input	
83	Subtraction (X − Y)	As Y Input	
84	Subtraction (Y − X)	As Y Input	
85	Subtraction (Y − X)	As Y Input	
86	Multiplication (X • Y)	Floating	
87	Multiplication (X • Y)	Floating	
88	Division (X / Y)	Floating	
89	Division (X / Y)	Floating	
90	Division (Y / X)	Floating	
91	Division (Y / X)	Floating	
92	Fourth Order Polynomial	User-Defined	See Function Description.
93	Simple Flow Model	User-Defined	See Function Description.
94	Relative Humidity	XXXX.X	See Function Description.
95	Equivalent Sterilization Time (ΔF)	XX.XXX	See Function Description.
96	Rolling Average	As Source	The Source Code specifies an accumulation function. Input 2 of the accumulation function specifies the source channel address of the data; output 2 specifies the number of samples, and the accumulation interval specifies the time between samples.
97	Rolling Maximum	As Source	
98	Rolling Minimum	As Source	
99	No Operation	—	See Function Description.

As shown in Table 5, the location of the input data for the various Channel Functions is function-specific and must be defined with care. In most cases, when a Channel Function is assigned to a Channel Address, a defined Source Code of 000 identifies a specific source location. If a source location other than the one specified by Source Code 000 is desired, the Source Code representing the desired Channel Address (in the range 101-816) must be defined. If no Source Code is specified for an assigned Channel Function, a Source Code of 000 will be entered automatically into the memory.

To assign a Channel Function to a Channel Address, press the CHANNEL key, followed by the desired 3-digit Channel Address, then press ENTER. Next, press the ASSIGN FUNCTION key, enter the 2-digit Function Code and the 3-digit Source Code, then again press ENTER.

When assigning a Channel Function to a series of consecutive Channel Addresses, these locations may be accessed sequentially by using the Increment (→) or Decrement (←) key. The following example demonstrates the keying sequence and displays involved in assigning Function Code 14 to Channel Addresses 201 and 202. The Source Codes for these two function assignments are 101 and 102, respectively.

These displays appear . . . **. . . when these sequences are keyed in the order shown**



Floating Point Computations

As indicated in Table 5, several of the Channel Functions compute data in floating point arithmetic. When using these functions, the position of the decimal point shifts automatically to provide the best output resolution possible within the 65,535 count limit. The decimal position in the output of these functions may be fixed by assigning linear functions (see page 40) to scale the data. Once its position is fixed, the decimal point will remain unaffected by changes in the input value.

Having the decimal position fixed in the output is particularly important in cases where subsequent operations performed on the data will ignore the decimal point. This is the case with Alarm Limit comparisons, accumulations, etc. As an example of the type of problems that can be encountered with floating point outputs, note that a high Alarm Limit of 6600 counts could be tripped by a floating point result of 6600., 660.0, 66.00, 6.600 or .6600.

Constants

In the following descriptions of Channel Functions, it will be noted that Constant values are often required as inputs for mathematical computations. In Digistrip III usage, a Constant may be defined during programming by the assignment of a linear function (see page 40). An easy way to do this is to assign a linear function to a Channel Address and specify its Source Code as 901 (an always active internal information storage location). To achieve the desired Constant output, define Input 1 of the linear function to be 0.0000 and Input 2 to be 1.0000. Finally, define both Output 1 and Output 2 to be the desired Constant.

As an example of Constant value programming, an atmospheric pressure Constant of 0.85 atmospheres might be specified by the assignment of linear function 45, with a Source Code of 901. Using this Source Code, Input 1 would be defined as 0.0000 and Input 2 as 1.0000. Both Output 1 and Output 2 would be defined as 000.85. If defined in this way, linear function 45 would provide a Constant output value of 0.85

FUNCTION DESCRIPTIONS

The Channel Functions listed in Table 5 are described in detail in the following subsections, in the order listed.

The Skip Function (Function 00)

Assigning Function 00 to any Channel Address causes the Digistrip III to skip that particular address and print no data. Whenever the Skip function is assigned, a Source Code of 000 must be specified.

Millivolt Scale Functions (Functions 01–03)

Functions 01, 02 and 03 select the 65.000 mv, 650.00 mv and 6500.0 mv input scales, respectively. Information on source data location and decimal point positioning are provided in Table 5.

NOTE

The 6500.0 mv scale may be displayed as 6.5000 V by assigning one of the user-definable linear functions (Functions 14-45) to re-position the decimal point in the output. To do this, define the function inputs and outputs as follows:

Input 1 = 0000.0
Output 1 = 0.0000
Input 2 = 1000.0
Output 2 = 1.0000

Standard Thermocouple Functions (Functions 04-09)

These functions comprise a series of standard thermocouple linearizations. They are used to convert thermocouple outputs to temperature readings in degrees Celsius or Fahrenheit. Their output resolution is registered as XXXX.X. The Standard Thermocouple functions operate on source data in the memory location to which the function is assigned.

Thermocouple outputs represent the temperature differential between their measuring junctions and terminal junctions (in this case, the Digistrip III's analog input connection terminals). In order to make these values meaningful, they must be referenced to the ice point ($0^{o}C$) or another known temperature standard.

In Digistrip III, thermocouple inputs are internally referenced to the ice point by specifying a Source Code of 000 whenever a thermocouple function is used. This internal ice point referencing is accomplished by the use of reference Platinum Resistance Temperature Detectors (RTDs) mounted inside the isothermal analog input terminal blocks.

When the use of an external temperature reference is required, the millivolt output of the reference thermocouple is added to that of each measuring thermocouple before the temperature scaling operation is performed. External temperature referencing systems require that the reference thermocouple be of the same type as the measuring thermocouples. The reference thermocouple input must be assigned to a separate Channel Address, with the appropriate voltage function (see Table 6) and a Source Code of 000 defined for that address. The location of this reference data must then be specified as the Source Code for each of the measuring thermocouple linearizations.

TABLE 6. REFERENCE THERMOCOUPLE FUNCTIONS

Thermocouple Type	Function Code Assigned to Reference Channel
E	01
J	01
K	01
R	13
S	13
T	13

If thermocouple inputs are to be received from a remote scanning device, the inputs for each measuring thermocouple type must be referenced to an appropriate thermocouple reference channel within the scanner.

Detailed information on the external referencing of thermocouples is provided in the *Digistrip III User's Guide Supplement.*

Standard RTD Functions (Functions 10 and 11)

Functions 10 and 11 are used to linearize outputs from 100 ohm Platinum RTDs (DIN 43760). These functions convert RTD outputs to temperature readings in degrees Celsius or Fahrenheit. Their output resolution is registered as XXX.X. The standard RTD functions operate on source data at the Channel Address to which the function is assigned. Whenever Function 10 or 11 is assigned to a Channel Address, its Source Code must be specified as 000.

High Resolution Type T Thermocouple (Function 12)

Function 12 provides a high resolution linearization of inputs from Type T thermocouples. The effective operating range of this function is -100 to +150°C. Function 12 operates in the same manner as Function 09, except that its temperature output is always expressed in degrees Celsius, with a resolution of 0.01°. Information on source data location is provided in Table 5.

32 mv Calibration Scale (Function 13)

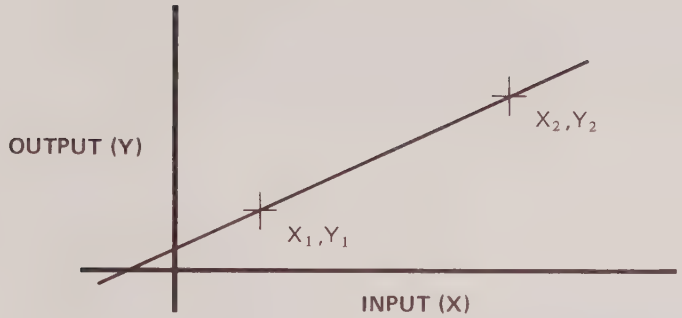
Function 13 is a special 32 mv scale, with 0.5 microvolt resolution. It is used to perform automatic calibrations on Types R, S and T reference thermocouples. Normally, Function 13 is not used for other purposes.

Linear Functions (Functions 14-45)

Functions 14-45 are designated as user-definable linear functions. They are used to define linear scaling for single input variables. A particular linear function may be assigned to one or more Channel Addresses. When a Source Code of 000 is specified for an assigned linear function, the source data is taken from the location to which the function is assigned. When a Source Code in the range 101-816 is specified, the source data is taken from the specified source location.

When the source data is taken from a location other than the one to which the linear function is assigned, the function operates in an indirect manner. Indirect linear functions are used to re-scale already scaled inputs such as thermocouple temperature readouts.

Whenever a linear function is assigned, two known points (X_1, Y_1 and X_2, Y_2) must be defined; the following diagram shows these points. Once the two known points are defined, the instrument automatically computes the slope and X intercept of the function.



X_1 = Input 1
Y_1 = Output 1
X_2 = Input 2
Y_2 = Output 2

The two known points are defined for the function by programming values for: Input 1, Output 1, Input 2 and Output 2.

The position of the decimal point in the output of a linear function will always be the same as the decimal position specified in Output 1.

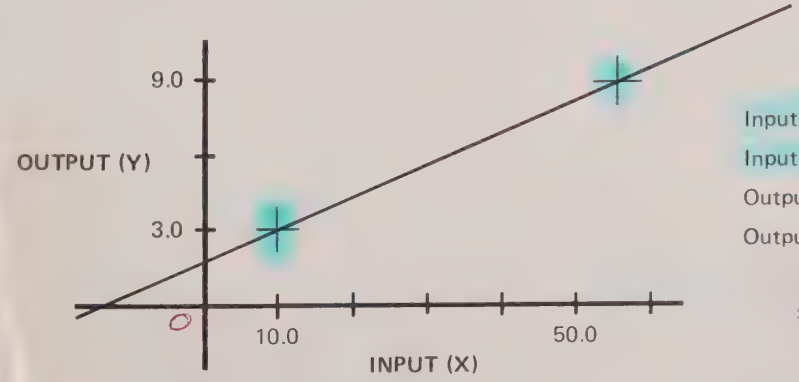
In addition to the defined Input and Output values, a single alphabetic character may be programmed to indicate the appropriate engineering units in the printed and displayed data.

The following example demonstrates the procedure used in defining Inputs 1 and 2 and Outputs 1 and 2 for a typical linear function.

EXAMPLE

A programmer wishes to define Function 14 as a linear function which will monitor pH readings over the range 3.0 to 9.0. The inputs at these two points are known to be 10.0 mv and 55.0 mv, respectively. The two known points are shown in the following diagram.

Input$_1$ Output$_1$
* 10mv = 3.0 PH
55mv = 9.0 PH
Input$_2$ Output$_2$



Input 1 (X_1)	= 10.000
Input 2 (X_2)	= 55.000
Output 1 (Y_1)	= 3.0
Output 2 (Y_2)	= 9.0

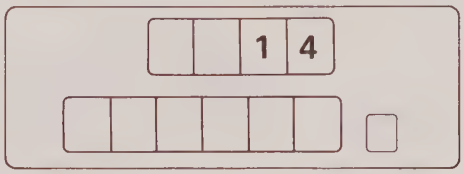
* ∴ ~~will~~ at 10mv there will BE 3PH AND AT 55mv it should BE 9 PH.

0 TO 9 PH = Y AXIS

= X AXIS

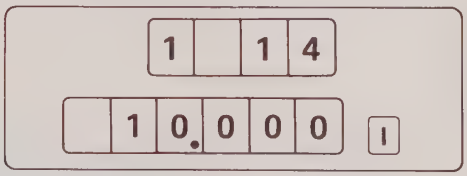
In preparation for entering the X and Y values of the two known points, first press the FUNCTION key, followed by the desired 2-digit function code (in this example, 14), then press ENTER. This action will call up the function and cause its number code to appear in the two rightmost positions of the upper LED display, as shown below.

By keying this sequence in the order shown . . . **. . . this display will appear**



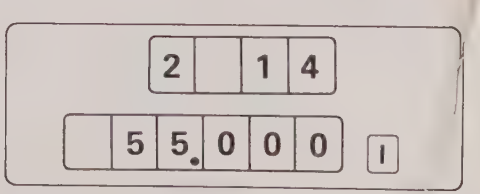
After entering the function code, press the FUNCTION INPUT key one time. This accesses Input 1 for programming and shows a "1" in the leftmost position of the upper display, indicating that Input 1 is accessed. To enter the value for Input 1, key in the appropriate 5-digit representation of X_1 (in this example, 10.000), then press ENTER. At this point, the value entered for Input 1 will appear in the lower display. It should be noted that the decimal point in Input 1 should be located to accommodate the largest expected input data value. The decimal point in Input 2 is automatically placed in the same location as that of Input 1.

By keying this sequence in the order shown . . . **. . . this display will appear**



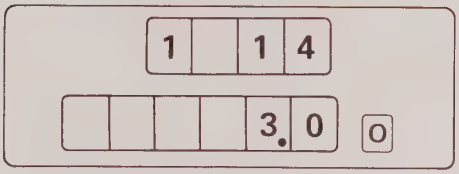
Once the value for Input 1 has been entered, pressing the FUNCTION INPUT key a second time will access Input 2 for programming. At the same time, a "2" (showing that Input 2 is accessed) will appear in the leftmost position of the upper display. Then, the 5-digit number representing the value of Input 2 (X_2) is entered in the same manner as for Input 1. In this example, Input 2 is entered as 55.000.

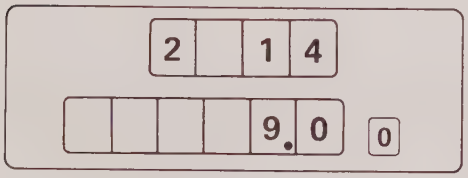
By keying this sequence in the order shown . . . **. . . this display will appear**



After entering Inputs 1 and 2, use the FUNCTION OUTPUT key to enter Outputs 1 and 2 (Y_1 and Y_2). These values are entered in the same manner as the Inputs described above. In this example, Output 1 is entered as 0003.0 and Output 2 as 0009.0. The decimal point location in the output data will be that specified in Output 1. Its location in Output 2 is automatically specified to be the same as Output 1.

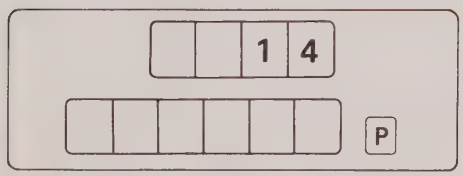
These displays will appear . . . **. . . when these sequences are keyed in the order shown**





Finally, the Units character "P" may be programmed to indicate pH units in the printed and displayed output. To do this, press UNITS, ALPHA SHIFT, P, then ENTER.

This display will appear . . . **. . . when this sequence is keyed in the order shown**



Accumulation Functions (Functions 46-61)

The Digistrip III provides 16 user-definable accumulation functions. These functions multiply source data by elapsed time in minutes. The product of the source data and elapsed time is then multiplied by a user-defined scaling factor called the *Accumulation Ratio.* The accumulation functions are used to total input data over a defined time period, such as flow volume per day. Each accumulation function may be assigned to one or more Channel Addresses.

All accumulation function computations are made on a 1-minute time base. The source data is actually sampled six times per minute (every 10 seconds). As each sample is taken, it is multiplied by the user-definable Accumulation Ratio, then added to the function's accumulation register. Prior to any data display or printout, the accumulated total is divided by six to provide a value normalized to the 1-minute time base. The computed value which is printed or displayed at any time, therefore, is equal to the average value of the source data, times the elapsed time in minutes, times the Accumulation Ratio. At the end of an Accumulation Interval, the accumulated total is automatically printed out and the accumulation register is cleared for the start of the next interval.

When an accumulation function is assigned to a Channel Address, its Source Code must specify the address from which the input data is to be taken. When the Source Code is specified as 000, the source data is taken from the Channel Address immediately above and in the same column as the assigned function. When the Source Code is specified as a Channel Address in the range 101-816, the source data is taken from the specified location.

Whenever an accumulation function is assigned, certain parameters must be defined to specify its operation. These parameters are:

- An Accumulation Interval (in minutes)
- Input 1
- Output 1
- An alphabetic Units character

The Accumulation Interval must be defined to be in the range 1-19999 minutes. This parameter specifies the time interval over which the accumulation will proceed. The alphabetic Units character causes the appropriate engineering units character to appear in the data display and printout. The values defined for Input 1 and Output 1 determine the scaling of the accumulation function. The technique used in selecting these values is described under Linear Functions (pages 40-43).

The maximum count limitation imposed by the Digistrip III software is 65,535 counts. Due to this limitation, whenever an accumulation function is assigned, care must be taken to ensure that the product of any maximum source data value times the Accumulation Ratio does not exceed 65,535 counts. If counts in excess of 65,535 are anticipated, appropriate scaling factors must be applied.

The Accumulation Intervals for all assigned accumulation functions are started simultaneously when the Auto Log feature is turned ON (see page 19). The accumulated total for each function is printed out at the end of its Accumulation Interval. Once this total is printed out, the accumulation register is reset to zero and accumulation begins again. Turning the Auto Log feature OFF during accumulations does not affect their operation.

The beginning and end of the Accumulation Interval for an individual accumulation function may be synchronized externally by the use of a contact closure switch. This switch must be wired to the input terminals assigned to the Channel Address to which the accumulation function is assigned. As long as the switch remains closed, the accumulation does not proceed. The accumulation begins when the switch is opened and continues until it is reclosed. Upon closure of the switch, the accumulated total is retained, then printed out at the start of the next minute. Once the accumulated total is printed out, the accumulation register is reset to zero in preparation for the start of another switch-initiated Accumulation Interval.

Switching to PROGRAM mode operation during an Accumulation Interval disrupts the accumulation. When this occurs, the accumulated total is printed out, the accumulation register reset to zero, and a new Accumulation Interval begun at the start of the first full minute after RUN mode operation is restored.

Accumulation functions treat negative inputs as zeros. Open circuits and overloads are indicated as OVRLD in printouts, and cause the Over Range lamp to light on the front panel. Accumulated totals are not destroyed by open circuits and overloads.

The following examples provide step-by-step instructions for determining and defining the operating parameters of an accumulation function.

EXAMPLE 1

A Digistrip III is to be used to accumulate flow volume measurements over an 8-hr period. The measurements will be made with a flow meter having a range of 0-100 gal/min.

PROCEDURE	EXAMPLE
A. Determine the Accumulation Interval (in minutes).	Accumulation Interval = 8 hrs X 60 mins = 480 mins
B. Determine the Time Conversion Ratio by dividing the minute accumulation base (1 minute) by the number of minutes in either the time units of the source data or the time units of the accumulated result. For example, if the source data is expressed in gallons per minute, the Time Conversion Ratio will be 1/1; if the accumulated result is expressed in kilowatt hours, the Time Conversion Ratio will be 1/60.	Time Conversion Ratio = 1/1
C. Determine the maximum expected accumulation value by multiplying the maximum expected source data value times the Accumulation Interval in minutes, times the Time Conversion Ratio.	Maximum Expected Accumulation Value = 100 X 480 X 1/1 = 48,000

PROCEDURE	EXAMPLE
D. Determine the Scaling Ratio to be used for the accumulation. If the maximum expected accumulation value (from step C above) does not exceed 65,535 counts, the Scaling Ratio will be 1/1. If the maximum expected accumulation value exceeds 65,535 counts, the Scaling Ratio will be the lowest possible decade scaling ratio (i.e., 1/10, 1/100, etc.) which will reduce this output below 65,535.	Scaling Ratio = 1/1
NOTE Keeping the Scaling Ratio low minimizes loss of output resolution.	
E. Determine the decimal point position to be assigned to Output 1 as follows:	
■ Examine the maximum expected accumulation value (see step C above). If this value is greater than 65,535 counts, its units must be changed to fit within the 65,535 maximum count limit. This may be done by changing gallons to kilogallons, etc.	Maximum Expected Accumulation Value = 48,000
■ Note the position of the decimal point in the five most significant (leftmost) digits of the units-adjusted maximum expected accumulation value. This will be the position assigned to the decimal point in Output 1.	Maximum Expected Accumulation Value = 48,000
F. Input 1 and Output 1 are the two values which determine the scaling of the accumulation function. Together, these two values may be considered as an Accumulation Ratio. Input 1 and Output 1 are determined as follows: Accumulation Ratio = Time Conversion Ratio X Scaling Ratio	Accumulation Ratio = 1/1 X 1/1 Accumulation Ratio = 1/1
G. Using the two elements of the Accumulation Ratio, enter the denominator as Input 1 and the numerator (with its decimal point positioned as shown in step E above) as Output 1.	Input 1 = 00001 Output 1 = 00001.
H. If desired, enter a single alphabetic Units character to designate the appropriate engineering units in the data display and printout.	G designates gallons

EXAMPLE 2

A Digistrip III is to be used to measure energy consumption in watt hours over a 24-hr period. The measurements will be made with a wattmeter having a range of 0-5000 watts.

PROCEDURE	EXAMPLE
A. Determine the Accumulation Interval (in minutes).	Accumulation Interval = 24 hrs X 60 mins = 1440 mins
B. Determine the Time Conversion Ratio by dividing the minute accumulation base (1 minute) by the number of minutes in either the time units of the source data or the time units of the accumulated result. For example, if the source data is expressed in gallons per minute, the Time Conversion Ratio will be 1/1; if the accumulated result is expressed in kilowatt hours, the Time Conversion Ratio will be 1/60.	Time Conversion Ratio = 1/60
C. Determine the maximum expected accumulation value by multiplying the maximum expected source data value times the Accumulation Interval in minutes, times the Time Conversion Ratio.	Maximum Expected Accumulation Value = 5000 X 1440 X 1/60 = 120,000 watt-hours
D. Determine the Scaling Ratio to be used for the accumulation. If the maximum expected accumulation value (from step C above) does not exceed 65,535 counts, the Scaling Ratio will be 1/1. If the maximum expected accumulation value exceeds 65,535 counts, the Scaling Ratio will be the lowest possible decade scaling ratio (i.e., 1/10, 1/100, etc.) which will reduce this output below 65,535.	Scaling Ratio = 1/10 (120,000 X 1/10 = 12,000 counts)

NOTE

Keeping the Scaling Ratio low minimizes loss of output resolution.

E. Determine the decimal point position to be assigned to Output 1 as follows:

- Examine the maximum expected accumulation value (see step C above). If this value is greater than 65,535 counts, its units must be changed to fit within the 65,535 maximum count limit. This may be done by changing gallons to kilogallons, watts to kilowatts, etc.

120,000 watt-hours X 1 KW/1000 W = 120.00 KWH

PROCEDURE	EXAMPLE
■ Note the position of the decimal point in the five most significant (leftmost) digits of the units-adjusted maximum expected accumulation value. This will be the position assigned to the decimal point in Output 1.	120.00 KWH
F. Input 1 and Output 1 are the two values which determine the scaling of the accumulation function. Together, these two values may be considered as an Accumulation Ratio. Input 1 and Output 1 are determined as follows: Accumulation Ratio = Time Conversion Ratio X Scaling Ratio	Time Conversion Ratio = 1/60 Scaling Ratio = 1/10 Accumulation Ratio = 1/60 X 1/10 Accumulation Ratio = 1/600
G. Using the two elements of the Accumulation Ratio, enter the denominator as Input 1 and the numerator (with its decimal point positioned as shown in step E above) as Output 1.	Input 1 = 00600 Output 1 = 000.01
H. If desired, enter a single alphabetic Units character to designate the appropriate engineering units in the data display and printout.	K designates kilowatt-hour

In this example, the operating parameters were determined to be:

- Accumulation Interval = 1440 mins
- Input 1 = 00600
- Output 1 = 000.01
- Units Designation = K

Once these parameters have been determined, they must be defined for a particular accumulation function. The procedure used for programming this information is similar to that shown in Example 1 above.

Interval Average (Function 62)

This function calculates a running average of data from a source Channel Address over the assigned Math Interval. If the Math Interval is set equal to zero, the time interval for Functions 62, 63 and 64 automatically is set equal to the Print Interval. Source data samples for Function 62 are taken at 10-second intervals. Each source data sample is added to the total of all previous samples taken during the current Math Interval. This total is then divided by the number of samples taken. Information on the location of input data and decimal point positioning is provided in Table 5.

Interval Maximum (Function 63)

Function 63 compares each source data sample with the prior maximum value obtained for the current Math Interval. If the current value is greater than the prior maximum, this value is stored as the new Interval Maximum. Information on the location of input data and decimal point positioning is provided in Table 5.

Interval Minimum (Function 64)

When Function 64 is assigned to a Channel Address, each new source data sample is compared with the prior minimum value for the Math Interval. If the current value is less than the prior minimum, this value is stored as the new Interval Minimum. Information on the location of input data and decimal point positioning is provided in Table 5.

Change Per Minute (Function 65)

At the start of each minute, this function calculates the difference between the current data value of each input and its value one minute previously. The Change Per Minute values are registered as either positive or negative numbers. Information on the location of input data and decimal point positioning is provided in Table 5.

Group Average, Maximum and Minimum (Functions 66-68)

These functions are used to update continually the Average, Maximum and Minimum values, respectively, of a defined group of source locations. Function 66 computes the Average value of the inputs for each memory update by totalling all the inputs, then dividing this total by the number of inputs in the group. Function 67 determines the Maximum input value for each memory update. Function 68 determines the Minimum input value.

The input groups for these functions are defined by the assignment of Source Codes. If a Source Code of 000 is specified, the input group will begin with the Channel Address immediately preceding the location to which the function is assigned and include all Channel Addresses at consecutively decreasing location numbers, until either Channel Address 101 or an address assigned the Skip function (Function 00) is encountered.

If a Source Code other than 000 is specified, the input group will begin with the Channel Address immediately preceding the location to which the function is assigned and include all Channel Addresses at consecutively decreasing location numbers through the address specified by the Source Code.

Math Interval Transfer (Function 69)

This function is used to transfer the current data value of a source location at the end of each Math Interval. The data is transferred from the Channel Address specified by the Source Code to the location to which the function is assigned. If the Math Interval is set equal to zero, the data is transferred at the Print Interval.

Function 69 is used primarily to create a historical record of inputs to a specific Channel Address. As normally applied, the function is assigned to a series of consecutive addresses, with each assigned function listing as its source the next higher numbered address. With the

instrument programmed for this operation only, a historical record of up to 127 measurements from a single source may be retained. Information on the location of input data and decimal point positioning is provided in Table 5.

Normal Transfer (Function 70)

Function 70 is used to transfer the current data value of a source location at each memory update. The data is transferred to the Channel Address to which Function 70 is assigned. Information on the location of input data and decimal point positioning is provided in Table 5.

Single Input Variables (Function 71-79)

These functions comprise a series of mathematical computation routines which act on single input variables. The inputs for Function 74-76 must be expressed in Radians; the outputs for Function 77-79 are expressed in Radians. Information on the locations of input data and decimal point positioning is provided in Table 5.

Two Input Variables (Functions 80-91)

Functions 80 through 91 make up a series of addition, subtraction, multiplication and division routines which operate on two input variables (X and Y). Functions are provided for carrying out these operations either horizontally or vertically within the Channel Address matrix. For the addition and multiplication routines, the relative positions of X and Y are unimportant. For the subtraction and division routines, however, the function must be selected such that X and Y will be correctly positioned in the equation. Information on source data location and decimal point positioning is provided in Table 5.

Fourth Order Polynomial (Function 92)

Function 92 is used to determine a fourth order polynomial (Y) defined by the equation:

$$Y = C_0 + C_1X + C_2X^2 + C_3X^3 + C_4X^4$$

For this function, if a Source Code of 000 is specified, the input variable (X) will be taken from the location immediately above the Channel Address to which Function 92 is assigned. If a Source Code other than 000 is defined, the input variable (X) will be taken from the specified source location.

The constants C_0, C_1, C_2, C_3 and C_4 are represented by values defined for the Input 1 and Output 1 memory locations of linear functions 39, 40, 41, 42 and 43, respectively. Input 1 of each of these functions must be defined as an appropriate base 10 exponent in the range +15 to -15. Output 1 must be defined as an appropriate mantissa. When defining Output 1 values for Functions 40, 41, 42 and 43, the decimal point must be placed immediately following the most significant (leftmost) digit. The position of the decimal point in the result is determined by the decimal point position specified in the mantissa of C_0 (Output 1 of Function 39). When defining these values, Input 2 and Output 2 need not be specified.

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Mass Flow Rate (Function 93)

Function 93 computes the mass flow rate of a compressible gas through an orifice or venturi-type flow meter. The calculation relates to the upstream and downstream pressure differential. The equation for this function is expressed as:

$$w = C_0 \sqrt{\frac{P}{T} \Delta P}$$

where: w = Mass Flow Rate
C_0 = A Proportionality Constant
P = Pressure (absolute)
T = Temperature (absolute)
ΔP = Difference between upstream and downstream pressure

When Function 93 is assigned, ΔP is taken from the Channel Address directly above the one to which the function is assigned. If a Source Code of 000 is specified, P is taken from the location immediately to the left of ΔP, and T is taken from the next Channel Address to the left of P. If a Source Code other than 000 is specified, P is taken from the source location specified, and T is taken from the next Channel Address to the left of P.

The constant C_0 is derived from Linear Function 44 (defined, but not assigned). Input 1 of this function is defined as an appropriate base 10 exponent in the range +15 to -15. Output 1 is defined as an appropriate mantissa.

The position of the decimal point in the result is determined by its position in the mantissa of C_0.

Function 93 may also be used to determine the Mass Flow Rate of a liquid of known density. For this computation, the density value must be substituted for P, and unity must be substituted for T.

Relative Humidity (Function 94)

This function is used to compute a continually updated Relative Humidity value (percentage). Inputs include wet and dry bulb temperatures and an atmospheric pressure reading or pressure constant. When Function 94 is assigned and a Source Code of 000 is specified, the atmospheric pressure or pressure constant input (in Atmospheres) is taken from the Channel Address immediately to the left of that to which the function is assigned. The dry bulb temperature input (in ^{o}C) is then taken from the location immediately to the left of the pressure input, and the wet bulb temperature input (in ^{o}C) is taken from the next channel to the left.

When a Source Code other than 000 is specified, the atmospheric pressure or pressure constant input (in Atmospheres) is taken from the Channel Address thus specified. In this case, the dry bulb and wet bulb temperature inputs (in ^{o}C), respectively, are taken from the two Channel Addresses immediately to the left of the pressure input.

If desired, Function 94 may be used to compute a Relative Humidity value using a dew point input, instead of a wet bulb input. In this case, the pressure input must be defined as zero, and the dew point input must be assigned to the location otherwise occupied by the wet bulb input.

The calculation used in Function 94 is expressed by the equation:

$$RH = 100 \frac{P(T_w) - K_1 P (1 + K_2 T_w) (T_d - T_w)}{p(T_d)}$$

where: RH = Percent Relative Humidity

T_w = Wet Bulb Temperature (^oC)

T_d = Dry Bulb Temperature (^oC)

$p(T_w)$ and $p(T_d)$ = Saturation Pressures (in Atmospheres) corresponding to wet bulb and dry bulb temperatures, respectively. These terms are calculated from:

$$p(T_w) = K_3 e^{-\left(\frac{K_4}{T + K_5}\right)}$$

$$p(T_d) = K_3 e^{-\left(\frac{K_4}{T + K_5}\right)}$$

P = Atmospheric Pressure (Atmospheres)

K_1 = 6.606×10^{-4} ($^oC^{-1}$)

K_2 = 1.151×10^{-3} ($^oC^{-1}$)

K_3 = 1.39×10^5 (Atmospheres)

K_4 = 3.929×10^3 (^oC)

K_5 = 2.317×10^2 (^oC)

Reference: ASTM E337.62

Equivalent Sterilizing Time (Function 95)

The specifications of heat sterilization processes normally require the product to be maintained at a base sterilizing temperature (e.g., 121.1°C) for a given period of time in order to ensure proper sterilization. Credit toward total process lethality can be given for time spent at temperatures other than the base temperature by computing the equivalent time at the base temperature according to the normal logarithmic survivial characteristics of microorganisms. The total equivalent time at the base sterilization temperature is known as the F value.

Function 95 computes an incremental value of F according to the following formula:

$$\Delta F = 10^{\frac{T - T_b}{Z}}$$

where: ΔF = Time in minutes at the base temperature equivalent to the sterilizing effect of one minute at the current measured product temperature.

T = Current measured temperature of product.

T_b = Base sterilization temperature.

Z = The temperature difference required to change the D-value* by a factor of 10.

**D-value: The time required to reduce the microbiological population by 90% (one Log cycle) at the particular exposure conditions.*

By integrating the values of ΔF during a process, the total equivalent time at the base temperature is determined.

When Function 95 is assigned to a Channel Address and a Source Code of 000 is specified, Input T is taken from the location immediately above that to which the function is assigned. When a Source Code other than 000 is specified, Input T is taken from the location specified. The values of T_b and Z are specified by Linear Function 45 (defined, but not assigned), with T_b defined as its Input 1 and Z defined as its Output 1.

NOTE

In steam sterilization, the values of T_b = 121.1C (250.0F) and Z = 10.0C (18.0F) are so universally accepted that the resulting F value has been designated F_o. In dry heat sterilization, there is a current trend to accept T_b = 170.0C (338.0F) and Z = 20.0C (36.0F) as similar standards and to designate the resulting F value as F_H.

The total value of F is computed by assigning an accumulation function to the Channel Address where the total value is to be located. The accumulation function samples the incremental value of F every 10 seconds and uses this input in computing the total F value. If the accumulation function is assigned to the Channel Address immediately below that to which Function 95 is assigned, its Source Code must be specified as 000. If the accumulation function is assigned to another Channel Address, its Source Code must specify the location to which Function 95 is assigned.

The resolution of ΔF is 0.001 minutes. When defining the accumulation function, it is normally recommended to enter 01.000 as Input 1 and 001.00 as Output 1. This will give an output resolution of 0.01 minutes. The Accumulation Interval should be large compared to the process time. Typically, an Accumulation Interval of 09000 minutes is defined.

If a minimum temperature is to be defined below which ΔF is always zero, this temperature must be programmed as Limit 1 on the channel to which Function 95 is assigned. Once the limit value has been programmed, it may be made inoperable as a normal limit, but still be operable as a limit on the ΔF calculation. This is done by pressing the NULL key, followed by the ENTER key.

The beginning and end of a ΔF accumulation may be synchronized externally by use of a contact closure switch. For details on the use of this procedure, see page 45.

Rolling Average, Maximum and Minimum (Functions 96–98)

Functions 96, 97 and 98 are used to compute the Average, Maximum and Minimum values, respectively, of a series of timed inputs. Whenever one of these functions is assigned to a Channel Address, its Source Code must be specified as the 3-digit representation of an accumulation function (i.e., 046, 047, etc., through 061). Input 2 of the accumulation function must be defined as the location of the input data, Output 2 must specify the maximum number of samples to be included, and the Accumulation Interval must specify the time interval (in minutes) between data samples. When using accumulation functions in this way, Input 1 and Output 1 need not be defined.

Data values for the Rolling Average, Maximum and Minimum functions are retained in special storage buffers. Up to 32 samples can be retained in each of these buffers. Once the maximum number of sample inputs is reached, the oldest input will be dropped from the buffer as each new sample is added.

A special feature of the Digistrip III allows the Accumulation Interval, used with Functions 96, 97 and 98, to be set equal to zero. When this is done, the time interval between data samples is 10 seconds. This feature may be used to reduce fluctuations in high accuracy measurements by means of the Rolling Average function (Function 96). Using this function with a specified 10-second Accumulation Interval, a number of inputs may be averaged together to provide a more stable data value. An example of this would be the use of Function 96 to average the previous six inputs from a high resolution Type T thermocouple (Function 12) to provide an averaged temperature value at 10-second intervals.

In addition to their basic applications, Functions 96, 97 and 98 may be used to cascade data. A typical example of this might involve assigning Function 96 to Channel Address 201 and defining this function such that it will determine the average value of inputs at 15-minute intervals over a 3-hour period. The same function might be assigned to Channel Address 202 and defined to average the inputs from Channel Address 201 (3-hour averages) over a 24-hour period. Function 96 might also be assigned to Channel Address 203 where the inputs from Channel Address 202 (24-hour averages) might be averaged over a 30-day period.

No Operation Function (Function 99)

The No Operation function is so-named because it does not operate directly on input data. Instead, it is used with the Interval Maximum and Minimum functions (63 and 64) and with the Group Maximum and Minimum functions (67 and 68) to register the time or location at which the maximum or minimum reading occurs.

Whenever the time of occurrence of an Interval Maximum or Minimum, or the location of occurrence of a Group Maximum or Minimum is to be registered, Function 99 must be assigned to the Channel Address immediately to the right of the location to which the appropriate maximum or minimum function is assigned. Whenever Function 99 is assigned, its Source Code must be specified as 000.

ALARM LIMITS

Each Channel Address may be assigned up to two Alarm Limits. These limits are chosen for any combination of High, Low or Rate-of-Change values. When Alarm Limits are assigned, data which equals or surpasses these limits automatically initiates an Alarm state.

Alarm Limits are assigned to a selected Channel Address by use of the LIMIT key. By pressing this key once, Limit 1 is accessed for programming. Pressing the LIMIT key a second time accesses Limit 2. When Alarm Limits are being programmed (or reviewed), the three rightmost digits of the upper LED display show the Channel Address accessed, while the leftmost digit shows a 1 or 2 to indicate which limit is accessed.

Alarm Limit 1 may be any one of the following limit types:

- High (upper bound)
- Low (lower bound)
- Rate-of-Change (per Math Interval)

Alarm Limit 2 may be either one of the following types:

- High (upper bound)
- Low (lower bound)

The limit type is selected by pressing the LIMIT TYPE key. This key calls up the High, Low and Rate-of-Change limit types on a revolving basis. The LIMIT TYPE key may be pressed as many times as needed to access the desired limit type. The limit type accessed is indicated by a letter H, L or C appearing in the character display.

An Alarm Limit is defined by entering its desired 5-digit value via the keyboard. The hyphen (-) key may be used to define a negative value. The decimal point position of a Channel Address's limit value is determined by the function assigned to that address and appears automatically in the same location as it does in the scaled output.

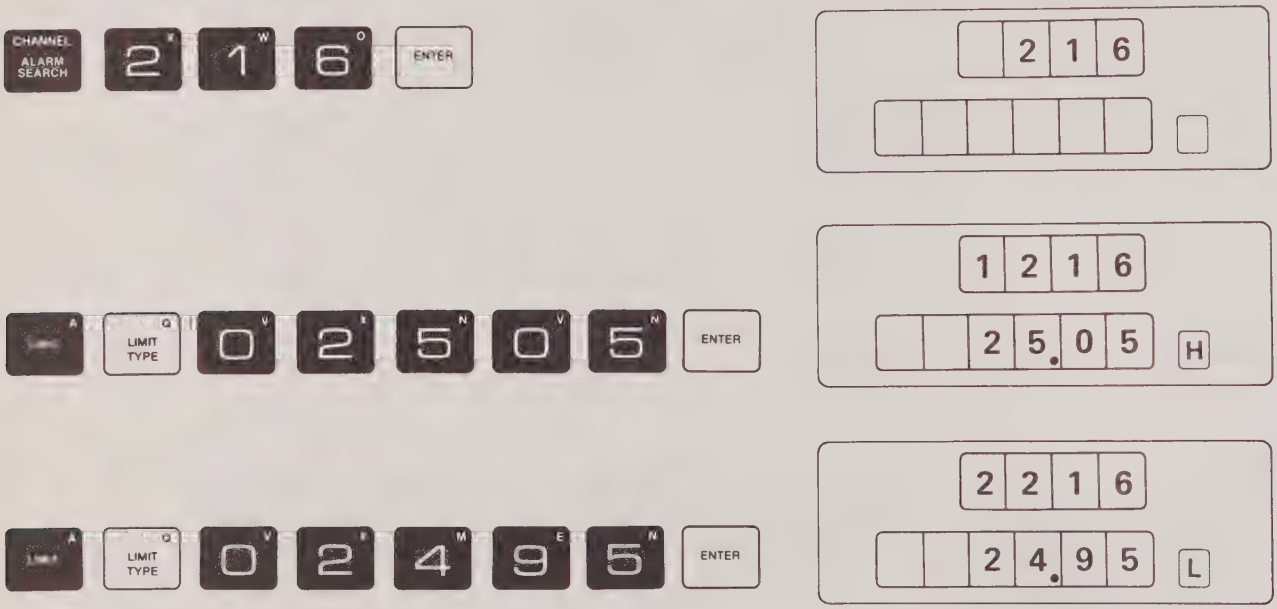
If an Alarm Limit is assigned to a Channel Address to which no function (or an undefined function) has been assigned, no decimal point will appear in the assigned limits.

With Functions 01 through 45, Alarm Limit checks are made on every data sample received. To reduce sensitivity to minor fluctuations in data values hovering near an Alarm Limit, an Alarm condition is not initiated until two consecutive data inputs are received which equal or exceed the specified Alarm Limit. With Functions 46 through 99, the Alarm Limits are checked every 10 seconds. As with Functions 01 through 45, Alarm conditions for these functions are not initiated until two consecutive data inputs are received which equal or exceed the specified Alarm Limit.

A hysteresis or dead band of 1 to 10 counts may be defined for Alarm Limit resets. This value is specified by appropriate selection of Digit 6 of Configuration Number 4 (see Table 4). Hysteresis of Alarm Limit resets reduces the instrument's sensitivity to minor fluctuations in input values exiting from an Alarm state.

The following example shows the keying sequences and displays involved in assigning Alarm Limits. In this example, Function 14 (a user-definable linear function) is assigned to Channel Address 216 and used to scale inputs from a pressure transducer. The function is defined to display output data in the XXX.XX format. A high limit (Limit 1) of 25.05 and a low limit (Limit 2) of 24.95 are to be assigned.

By keying these sequences in the order shown . . . **. . . these displays will appear**



ALARM RELAYS

Each Digistrip III contains two internal Alarm Relays. These are designated as the Even and Odd Alarm Relays. In addition, up to 48 external relays may be added to the system. The external relays are provided as an option by use of a Kaye Model RD-48 Relay Driver and one or more Model RC-8R Relay Closure modules.

The Alarm Relays are controlled by Alarm Limits. In order for a particular Alarm Limit to control a relay, a Relay Address Code must be assigned to that limit. Up to 48 unique Relay Address Codes may be assigned. These 48 codes provide for control of the two internal relays as well as the optional external relays. A particular Relay Address Code may be assigned to any number of Alarm Limits.

Each Relay Address Code consists of a 3-digit number. The first digit specifies certain instrument operating parameters as described in Table 7. This first digit must be in the range 0-3.

The last two digits must be in the range 01-48. These digits specify the control of a particular relay. When the system is equipped with the external relay option, the last two digits specify control of the correspondingly numbered external relay. When only the two internal relays are used, the last two digits specify control of these relays.

TABLE 7. RELAY ADDRESS CODES – FIRST DIGIT SELECTION

Digit	Instrument Operations
0	■ Trip alarm on open circuit or overload ■ Print alarm log on alarm trip ■ Sound beeper on alarm trip
1	■ Do not trip alarm on open circuit or overload ■ Print alarm log on alarm trip ■ Sound beeper on alarm trip
2	■ Trip alarm on open circuit or overload ■ Do not print alarm log on alarm trip ■ Do not sound beeper on alarm trip
3	■ Do not trip alarm on open circuit or overload ■ Do not print alarm log on alarm trip ■ Do not sound beeper on alarm trip

By appropriate definition of Digit 1 of Configuration Number 4 during programming (see Table 4), the internal Alarm Relays may be made to operate in any one of several modes. When using the internal relays, once the desired relay operating mode has been selected, Relay Address Codes may be assigned to Alarm Limits in any combination desired.

In this most common internal relay operating mode, Digit 1 of Configuration Number 4 is defined as 0. In this mode, when the last two digits of a Relay Address Code comprise an *odd* number (i.e., 01, 03, . . . 47), control of the Odd internal relay is specified. In this same mode, when the last two digits comprise an *even* number (i.e., 02, 04, . . . 48), control of the Even internal relay is specified. Figure 18 shows the relay assignment scheme for this most common internal relay operating mode.

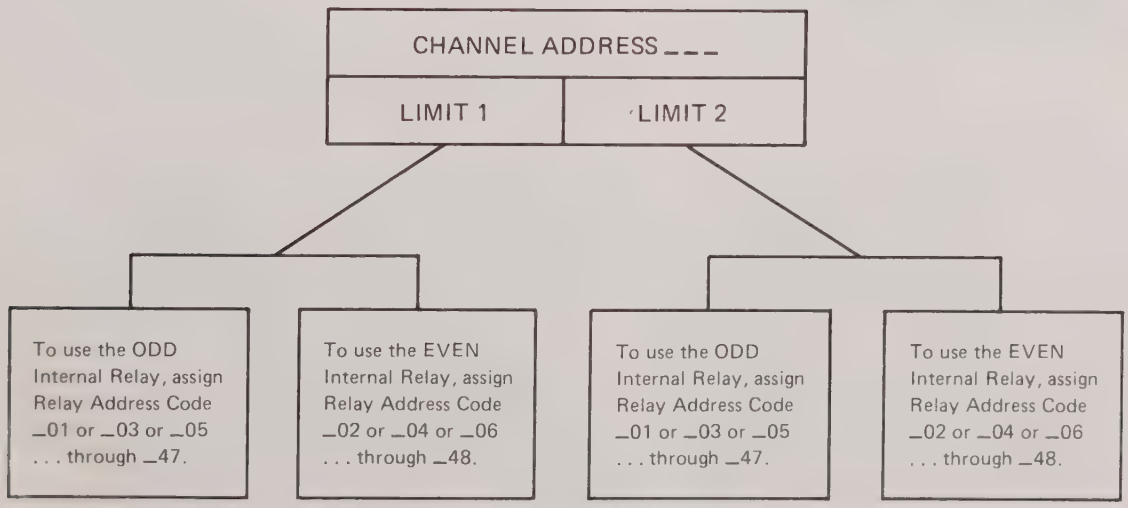

CHANNEL ADDRESS ___
LIMIT 1
LIMIT 2
To use the ODD Internal Relay, assign Relay Address Code _01 or _03 or _05 . . . through _47.
To use the EVEN Internal Relay, assign Relay Address Code _02 or _04 or _06 . . . through _48.
To use the ODD Internal Relay, assign Relay Address Code _01 or _03 or _05 . . . through _47.
To use the EVEN Internal Relay, assign Relay Address Code _02 or _04 or _06 . . . through _48.

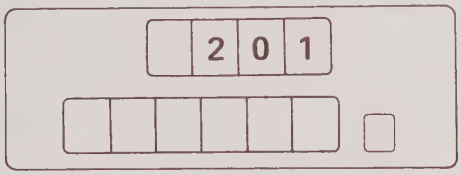
FIGURE 18. INTERNAL RELAY ASSIGNMENT SCHEME (Most Common Mode)

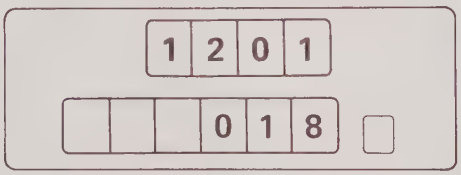
Alarm Relays are assigned by use of the RELAY NUMBER key. To assign Alarm Relays to the Alarm Limits of a particular Channel Address, first call up the desired address via the keyboard. Next, access Limit 1 for relay assignment by pressing the RELAY NUMBER key one time. Then key in the selected 3-digit Relay Address Code and press ENTER. To assign an Alarm Relay to Limit 2 at the same address, press the RELAY NUMBER key a second time. Then enter the selected Relay Address Code for that limit.

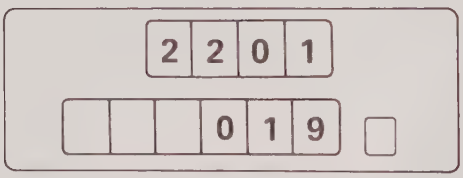
The following example shows the keying sequences and displays involved in assigning Relay Address Code 018 to Limit 1 of Channel Address 201, and Relay Address Code 019 to Limit 2 at the same address.

By keying these sequences in the order shown . . .

. . . these displays will appear







HEADERS

Up to nine lines of header information (Lines 100-900) may be printed at the top of each page of data. In addition, a tenth line always appears. This line is permanently programmed to provide date and column number information. Figure 19 shows a sample header printout.

```
12      PAN WORLD INDUSTRIES BUILDING 6 CO-GENERATION PLANT          PLANT STATUS MONITOR
1125       01      02      03      04      05      06      07      08      09      10      11      12      13      14      15      16
100              GAS TURBINE OPERATING PARAMETERS
200     STG 1-1 STG 1-2 STG 1-3 STG 2-1 STG 2-2 STG 2-3 STG 3-1 STG 3-2 STG 3-3 AVE TEMP  MIN.  LOCATION   DEV     RPM  VIB. MILS
300              GENERATOR   PARAMETERS          STEAM PRODUCTION UNIT                          LOW PRESSURE  TURBINE
400     GEN. MW  MW-HRS FWD BRG AFT BRG BRG.PLAY EXH GAS ST.TEMP ST.PRES DELTA P LBS/HR TOTL LBS TURB.KW KW-HRS  FWD BRG AFT BRG  VIB.
```

FIGURE 19. SAMPLE HEADER PRINTOUT

Header information is programmed via the keyboard. The numbers, letters, symbols and spaces shown on the keyboard may be entered into the header lines in any combination desired. Normally, however, headers are programmed to provide general information (e.g., process identification), as well as specific information (e.g., sensor locations, engineering units) for the various Channel Addresses.

Each of the 9 programmable header lines consists of 16 8-character fields as shown in Figure 20. The header fields are identified by 3-digit numbers (101-116 to 901-916). The first digit indicates the header line; the last two digits indicate the column.

In addition to the normal headers, a series of Alarm Messages and Serial Transmission Start and End Messages may be programmed into the secondary memory of the header lines. Details on the programming of these messages are provided on pages 63-65.

To access a header field for programming, first call up the desired header field by pressing the CHANNEL key and entering the appropriate 3-digit Header Field Code. Next, press the ENTER and HEADER keys. When a header field is accessed, its location code appears in the three rightmost positions of the upper LED display. At the same time, a "1" appears in the leftmost position of the upper display; this number indicates that the header field's primary memory is accessed.

Whenever a header field is accessed for programming, a character position number (in the range 1-8) appears in the rightmost position of the lower display. This number changes sequentially as the individual characters are programmed. Figure 21 shows the header programming display.

When programming header information, numbers are entered by pressing the number keys. To enter one or more letters, first press the ALPHA SHIFT key, then press the desired letter keys. Once the ALPHA SHIFT key has been pressed, the keyboard remains in the Alpha Shift mode until either (1) the ENTER key is pressed, or (2) the ALPHA SHIFT key is pressed a second time. During programming operations, the Alpha Shift mode is indicated by the presence of an illuminated (-) in the leftmost position of the lower LED display; the Normal keyboard mode is indicated by the presence of a (_) in this position.

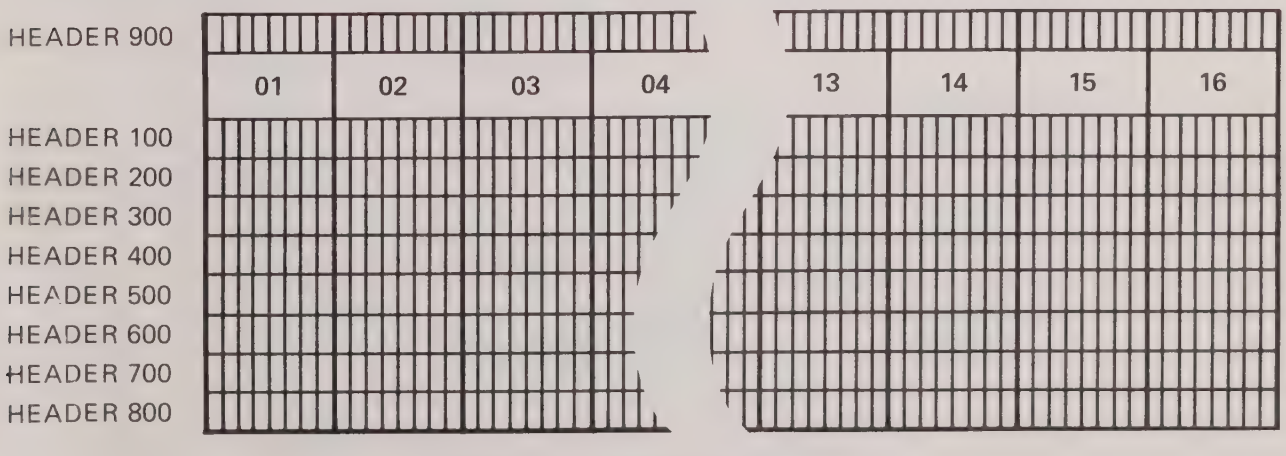


FIGURE 20. HEADER FIELD FORMAT

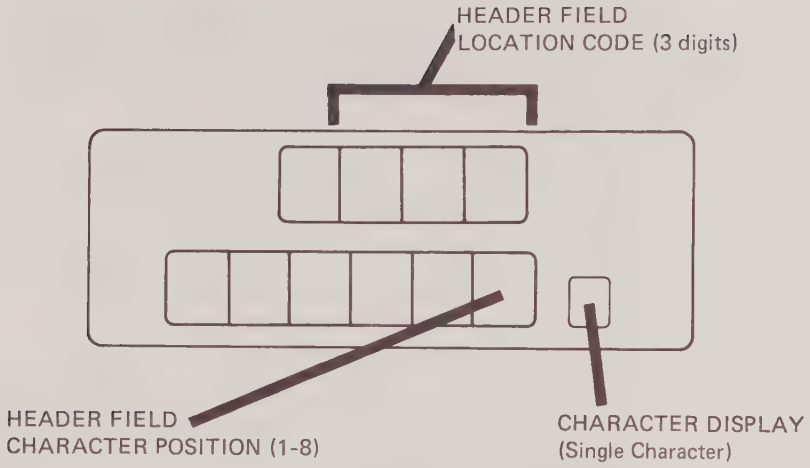


FIGURE 21. HEADER PROGRAMMING DISPLAY

As each character is entered into a header field, it will appear in the character display. Simultaneously, this character will be loaded into a temporary storage buffer. In the Alpha Shift mode, spaces are entered by pressing the SPACE key. In the Normal mode, spaces are entered by pressing the CHANGE key.

If an incorrect entry is made in the Alpha Shift mode, the field may be cleared for reprogramming by pressing the ALPHA SHIFT, NULL and ENTER keys. In Normal mode, the field may be cleared by pressing the NULL and ENTER keys.

Once the desired characters and spaces (up to 8) have been programmed into a particular header field buffer, this information may be entered into memory by pressing the ENTER key. To move on to the next field, press the Increment (→) key. Examples of header programming are provided in the following subsections.

General Information Headers

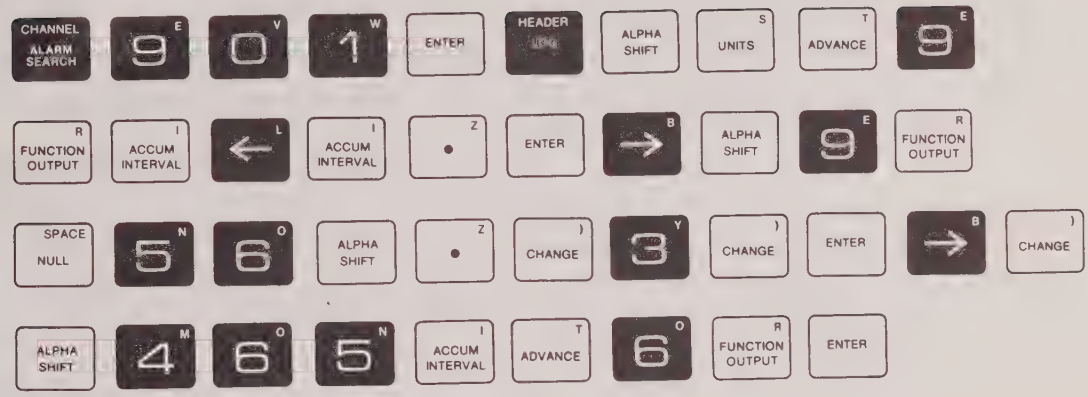
The first header line (Line 900) is normally programmed to provide general information on the process being monitored. Other header lines may be used for this purpose, as well. General Information Headers are optional; if none is desired, nothing needs to be programmed.

The following example demonstrates the keying sequence used in programming the General Information Header "STERILIZER NO. 3 MONITOR." In this example the header will begin in header field 901.

NOTE

Remember: When programming spaces into header fields, use the CHANGE key when in the Normal mode, and use the SPACE key when in the Alpha Shift mode.

Key this sequence in the order shown.

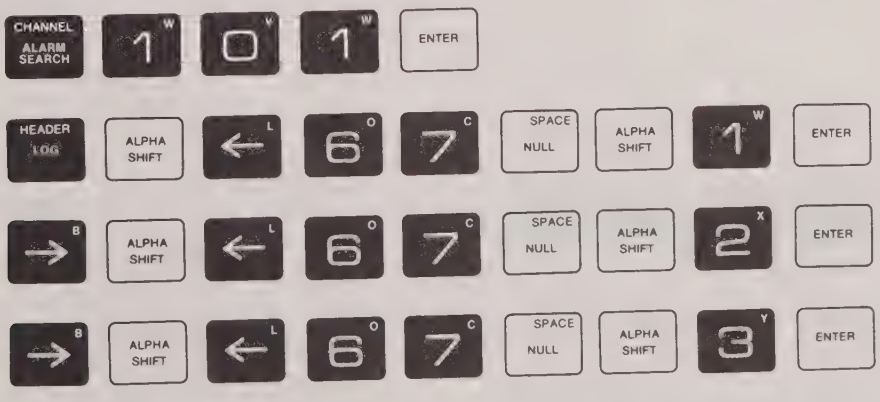


Channel Tag Headers

Header Lines 100 through 800 are designated as Channel Tag Headers. Each of these lines contains 16 header fields which correspond to the 16 columns of Channel Addresses. The Channel Tag Headers are normally programmed to provide identifying information on Channel Address data. Alternately, some of these lines may be used as additional General Information Headers. Header line printouts are controlled by the digits defined for Configuration Number 2 (see Table 2). Only those lines which are configured for printing will appear in the printout.

The following example demonstrates the keying sequence used in programming sensor locations 1 through 16 (LOC 1, LOC 2, etc.) into header fields 101, 102, etc.

Key this sequence in the order shown.



TIME INTERVALS

Three separate time intervals may be defined to control Digistrip III operations:

- *Print Interval* — Defines the period between Auto Log data printouts.
- *External Transmission Interval* — Specifies the interval at which data may be transmitted to an external device (computer, etc.)
- *Math Interval* — Controls the timed operations involved in Functions 62–64 (the Interval Average, Maximum and Minimum functions) and Function 69 (the Math Interval Transfer function), as well as the Rate-of-Change Alarm Limits.

The three time intervals are expressed in minutes. Each may be specified as any interval between 0 and 19999 minutes (approximately two weeks).

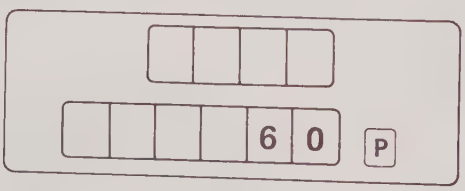
The time intervals are programmed by use of the TIME INTERVAL key. Pressing this key once accesses the Print Interval for definition. Pressing it a second time calls up the External Transmission Interval. Pressing it a third time causes the Math Interval to be accessed. As the intervals are accessed, their desired time intervals may be defined. The letter P, X or M, respectively, will appear in the character display to indicate which interval is accessed.

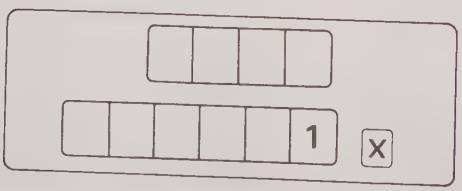
If any one of the time intervals is defined to be zero minutes, its operation will occur at 10-second intervals (or multiples thereof). If the Math Interval is left undefined, its operation will occur at the Print Interval. If Digit 4 of Configuration Number 3 (see Table 3) is defined to be 4, the Print Interval and External Transmission Interval will always be the same.

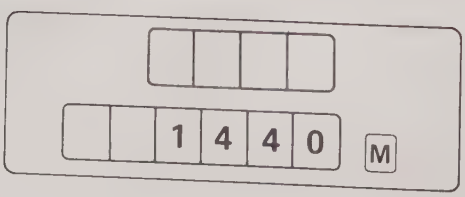
The following example shows the keying sequences and displays involved in programming a Print Interval (P) of 60 minutes, an External Transmission Interval (X) of 1 minute, and a Math Interval (M) of 1440 minutes (24 hours).

By keying these sequences in the order shown . . .

. . . these displays will appear







REAL TIME CLOCK

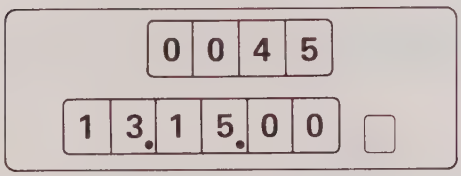
The Real Time Clock is used to keep track of day and time, providing this information for display and printout. The Clock consists of a 10-digit display in two parts. The upper display shows 4 digits representing days; the lower display shows 2 digits each for hours, minutes and seconds. The format for entering the day and time string is DDDHHMMSS, where:

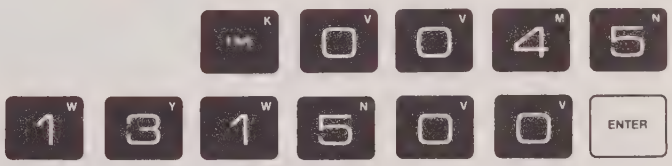
DDDD	is an appropriate 4-digit day code
HH	is a 2-digit hour code in the range 00–23
MM	is a 2-digit minute code in the range 00–59
SS	is a 2-digit second code in the range 00–59

The Real Time Clock must be set during PROGRAM mode operation, as follows: Press the TIME key, enter the appropriate 10-digit string, then press ENTER. The clock is started when the ENTER key is pressed.

The following example shows the keying sequence and display involved in setting the clock for exactly 1:15 pm on February 14 (45th day of year).

This display will appear . . . **. . . when this sequence is keyed in the order shown**





NOTE

The day counter increments once each day. It is normally used to count days numerically, without month designations. Both month and day numbers may be indicated by manually resetting the display at the beginning of each month. Using the month and day display, February 14 would be represented as 0214 (see above).

ALARM MESSAGES

A series of Alarm Messages may be programmed to print out whenever Alarm Limits are violated. Alarm Message printouts are initiated by Relay Address Codes assigned to specific Alarm Limits. A single Relay Address Code may be assigned to one or more limits. Each of the first 32 Relay Address Codes (Codes _01 through _32) may be programmed to initiate a separate Alarm Message. Alarm Messages indicating the start of Alarm conditions contain the following information:

- Time
- Location (Channel Address) of Alarm
- Alarm Data Value with Asterisk (*)
- Relay Number Assigned
- Message (up to 32 characters)

Alarm Messages may be made to print out at the end of an Alarm condition, as well. This action occurs automatically when the Odd relay is configured to pulse on any relay entering or exiting Alarm (i.e., when Digit 1 of Configuration Number 4 is defined as 2 or 6). Alarm Messages indicating the end of Alarm conditions contain time, location and data value information only. Figure 22 shows sample Alarm Message printouts.

```
14:39:47 102  203.1F*    2 WARNING BOILER NO. 1
14:40:22 102  269.0F*    1 DANGER  BOILER NO. 1
14:41:07 102  169.9F
```

FIGURE 22. SAMPLE ALARM MESSAGE PRINTOUTS

If a blank line is desired after each series of Alarm Message printouts, the instrument must be configured to provide a blank line after each Log (i.e., Digit 4 of Configuration Number 1 must be defined to be 4, 5, 6 or 7). If the instrument is configured to print relay numbers with each Log (i.e., if Digit 3 of Configuration Number 1 is defined as 1, 3, 5 or 7), these numbers will also be printed with the Alarm Messages.

Each Alarm Message is programmed into the secondary memory of a series of header fields. These memory locations are known as Alarm Message Fields. The messages are identified by their Relay Address Codes. Four Alarm Message Fields (32 character positions) are reserved for programming each message. Figure 23 shows the format for Alarm Message programming.

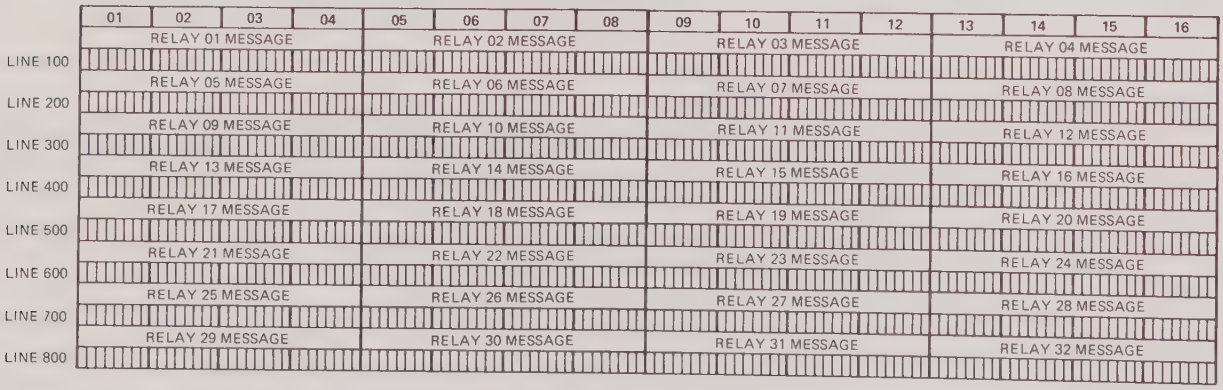


FIGURE 23. ALARM MESSAGE PROGRAMMING FORMAT

When programming an Alarm Message, first specify an Alarm Limit for a selected input. Next, assign a Relay Address Code (in the range 01-32) to that Alarm Limit. Following this, program the desired Alarm Message into the appropriate Alarm Message Fields (see Figure 23 above).

To access an Alarm Message Field for programming, press the CHANNEL key, then enter the appropriate 3-digit Alarm Message Field Code (e.g., Code 201 designates the first Alarm Message Field for Relay Message Code 05). Next, press the ENTER key once and the HEADER key twice.

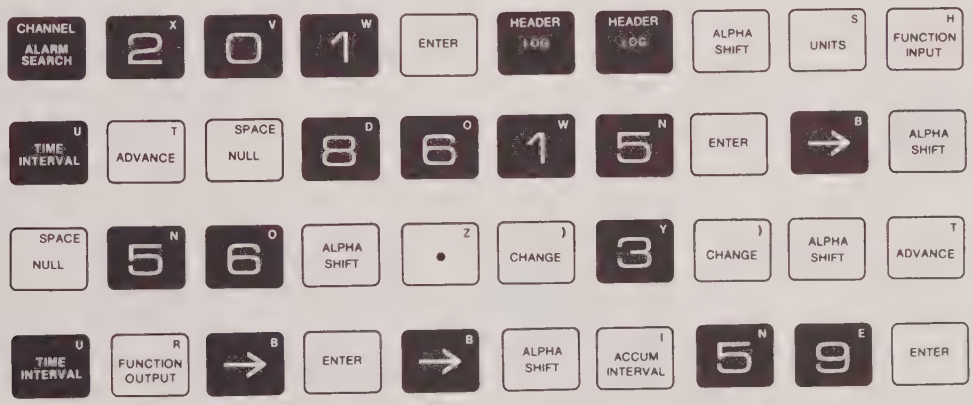
When an Alarm Message Field is accessed for programming, its location code appears in the three rightmost positions of the upper LED display, and a "2" (indicating secondary memory) appears in the leftmost position.

Whenever an Alarm Message Field is accessed for programming, a character position number (in the range 1-8) appears in the rightmost position of the lower display. This number changes sequentially as the individual characters are programmed. The Alarm Message programming display is the same as the Header programming display shown in Figure 21.

When programming Alarm Messages, numbers, letters, symbols and spaces are entered via keyboard in the same manner as described for programming headers (see pages 59 and 60).

The following example demonstrates the keying sequence used in programming the Alarm Message "SHUT DOWN NO. 3 TURBINE" for Relay Code 05 assigned to a particular Alarm Limit. As indicated in Figure 23, the Alarm Message for Relay Code 05 must be programmed into Alarm Message Fields 201-208.

Key this sequence in the order shown.



NOTE

When Alarm Messages are assigned to both Limit 1 and Limit 2 of a particular Channel Address, such as when a warning limit and a critical limit are both assigned, the Limit 2 message will not print if Limit 1 is already exceeded. Instead, Limit 1 will print again. In order for both Limits 1 and 2 to print out, Limit 2 must always be assigned as the warning limit and Limit 1 as the critical limit.

SERIAL TRANSMISSION START AND END MESSAGES

When Digistrip III outputs are to be transmitted to a computer, it is sometimes necessary to provide transmission Start and End Messages as part of the serial data stream. This may be accomplished by programming encoded characters into two special memory locations.

Each message may contain up to 31 encoded ASCII characters. These characters may be assigned in any combination desired. Each ASCII character is defined by programming a combination of two hexadecimal keyboard characters. Table 8 lists the keyboard character combinations available for programming, together with their ASCII character equivalents.

TABLE 8. HEXADECIMAL/ASCII EQUIVALENTS

00 NUL	20 SP	40 @	60 `
01 SOH	21 !	41 A	61 a
02 STX	22 "	42 B	62 b
03 ETX	23 #	43 C	63 c
04 EOT	24 $	44 D	64 d
05 ENQ	25 %	45 E	65 e
06 ACK	26 &	46 F	66 f
07 BEL	27 '	47 G	67 g
08 BS	28 (	48 H	68 h
09 HT	29)	49 I	69 i
0A LF	2A *	4A J	6A j
0B VT	2B +	4B K	6B k
0C FF	2C ,	4C L	6C l
0D CR	2D -	4D M	6D m
0E SO	2E .	4E N	6E n
0F SI	2F /	4F O	6F o
10 DLE	30 0	50 P	70 p
11 DC1 (X-ON)	31 1	51 Q	71 q
12 DC2 (TAPE)	32 2	52 R	72 r
13 DC3 (X-OFF)	33 3	53 S	73 s
14 DC4 ~~(TAPE)~~	34 4	54 T	74 t
15 NAK	35 5	55 U	75 u
16 SYN	36 6	56 V	76 v
17 ETB	37 7	57 W	77 w
18 CAN	38 8	58 X	78 x
19 EM	39 9	59 Y	79 y
1A SUB	3A :	5A Z	7A z
1B ESC	3B ;	5B [	7B {
1C FS	3C <	5C \	7C |
1D GS	3D =	5D]	7D } (ALT MODE)
1E RS	3E >	5E Λ (↑)	7E ~
1F US	3F ?	5F — (←)	7F DEL (RUB OUT)

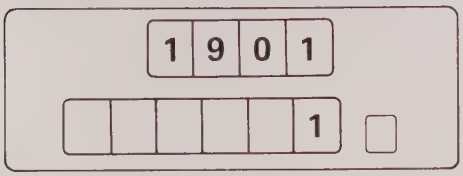
The Serial Transmission Start Message is programmed into the secondary memory of header field 901-908; the End Message is programmed into the secondary memory of header fields 909-916. These messages are programmed in much the same manner as the Alarm Messages (see page 63). Figure 24 shows the programming format used.

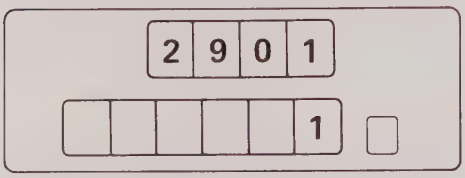
FIGURE 24. SERIAL TRANSMISSION START AND END MESSAGE PROGRAMMING FORMAT

To program a Start Message, first call up the secondary memory of header field 901. This memory location is accessed by pressing the HEADER key twice. Then, refer to Table 8 and Figure 24 and program the desired message characters. The characters must be programmed in consecutive order, beginning with character position 1 of field 901. Each message must be terminated with a blank.

The following example shows the keying sequence and displays involved in programming the single ASCII character STX as the Start message.

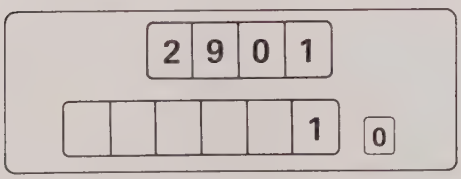
These displays will appear . . . **. . . when this sequence is keyed in the order shown**

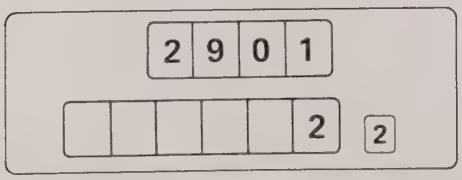


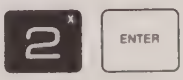


Using Table 8, the hexadecimal keyboard character combination equivalent of ASCII character STX is found to be 02. As the keys are pressed to enter the characters 0 and 2, a 0 and a 2 will appear simultaneously in the character display as shown below.

These displays will appear . . . **. . . when this sequence is keyed in the order shown**







To program an End Message, call up the secondary memory of header field 909, then enter the desired message character(s) as shown above for Start Messages.

LIST PROGRAM

Programmed instructions may be listed in the printout for inspection or as a record of the operating program. This printed information may be obtained in either of the following formats:

- Header and Channel Program
- User-Defined Function Program

In order to obtain a program printout, the Digistrip III must be set in PROGRAM mode. To initiate a printout of programmed Header and Channel information, press the CHANNEL key followed by the LIST PROGRAM key. Figure 25 shows a sample Header and Channel program printout. If a printout of programmed information on User-Defined Functions is desired, press the FUNCTION key followed by the LIST PROGRAM key. Figure 26 shows a sample printout of this program. Once the LIST PROGRAM key is pressed, the instrument will immediately print out all programmed instructions for the List Program format selected.

PROGRAM OFFLOADING AND RELOADING

When used in connection with the optional Kaye Model CPL Cassette Program Loader, a Digistrip III is capable of offloading or reloading program information. Offloaded programs are stored on recording tape. Using this system, a complete program can be offloaded or reloaded in less than two minutes.

The program offload/reload feature is particularly useful where a single unit is to be used for more than one application. It also is useful where multiple units are to be utilized for identical monitoring operations.

A special feature of the Kaye Cassette Program Loader is its ability to correct recording and playback errors automatically. Details on the program offload/reload option are provided in the *Cassette Program Loader Manual.*

As alternatives to the use of the Kaye Cassette Program Loader, the program offload/reload feature may be used with certain other digital cassette recorders. For details on the use of other equipment, contact Kaye Instruments.

```
12       PAN WORLD INDUSTRIES BUILDING 6 CO-GENERATION PLANT          PLANT STATUS MONITOR
1125        01       02       03       04       05       06       07       08       09       10       11       12       13       14       15       16
100               GAS TURBINE OPERATING PARAMETERS
200      STG 1-1 STG 1-2 STG 1-3 STG 2-1 STG 2-2 STG 2-3 STG 3-1 STG 3-2 STG 3-3 AVE TEMP  MIN.  LOCATION   DEV     RPM  VIB. MILS
300              GENERATOR   PARAMETERS          STEAM PRODUCTION UNIT                                LOW PRESSURE  TURBINE
400      GEN. MW  MW-HRS FWD BRG AFT BRG BRG.PLAY EXH GAS ST.TEMP ST.PRES DELTA P LBS/HR TOTL LBS TURB.KW KW-HRS  FWD BRG AFT BRG  VIB.
500
600
700
800

FUNCTION 05.000  05.000  05.000  05.000  05.000  05.000  05.000  05.000  05.000  66.000  68.000  99.000  70.405  14.000  15.000  00.000
200      16.000  46.201  09.000  09.000  17.000  05.000  06.000  18.000  19.000  70.503  47.210  20.000  48.212  09.000  09.000  15.000
300      00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000
400      25.207  26.208  70.209  70.111  82.110  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000
500      00.000  00.000  93.208  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000
600      00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000
700      00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000
800      00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000  00.000

INPUT 1  . . . . . .
200      . . . . . .
300      . . . . . .
400          0.0      0.0 . . . . . .
500      . . . . . .
600      . . . . . .
700      . . . . . .
800      . . . . . .

INPUT 2  . . . . . .
200      . . . . . .
300      . . . . . .
400          0.0      0.0 . . . . . .
500      . . . . . .
600      . . . . . .
700      . . . . . .
800      . . . . . .

CONFIGURATION NUMBER = 600420 740120 600162 032305
```

FIGURE 25. SAMPLE PROGRAM PRINTOUT – HEADERS AND CHANNELS (sheet 1)

```
1125    01    02    03    04    05    06    07    08    09    10    11    12    13    14    15    16

LIMIT 1 1400.0H 1400.0H 1400.0H 1400.0H 1400.0H 1400.0H 1400.0H 1400.0H 1400.0H                  1000 H 14000 H  2.00H.
200                      135.0H  135.0H  15.0H.                                                                  2.00H
300
400
500
600
700
800

RELAY 1      2       2       2       3       3       3       4       4       4                       1      10       5
200                          6       7       8
300                                                                                                                  11
400
500
600
700
800

LIMIT 2
200                                                                                                  12500 H.
300                                          -15.0L.
400
500
600
700
800

RELAY 2
200                                                                                                          9
300                                          8
400
500
600
700
800

100  CHECK FOR PLUGGED INJECTOR          STAGE 1 - OVERTEMPERATURE ALARM STAGE 2 - OVERTEMPERATURE ALARM STAGE 3 - OVERTEMPERATURE ALARM
200  VIBRATION TRIP-GAS TURBINE          FORWARD BEARING OVERTEMPERATURE AFT BEARING OVERTEMPERATURE      CHECK GENERATOR AXIAL PLAY
300  TURBINE OVERSPEED ALERT             TURBINE OVERSPEED--SHUT DOWN HOW VIBRATION TRIP-STEAM TURBINE
400
500
600
700
800
900  2430505340204236                                    04
```

FIGURE 25. SAMPLE PROGRAM PRINTOUT — HEADERS AND CHANNELS (sheet 2)

FNCTN	14 30	15 31	16 32	17 33	18 34	19 35	20 36	21 37	22 38	23 39	24 40	25 41	26 42	27 43	28 44	29 45
INPUT 1	250.0 0	0.00 0	250.0 0	-1000.0 0	250.0 0	250.0 0	250.0 0	0 0	0 0	0 0	0 0	0.0 0	0.0 0	0 0	0 1	0 0
OUTPUT 1	0 0	0.00 0	0.000 0	-25.0 0	0.0 0	0.0 0	0.000 0	0 0	0 0	0 0	0 0	273.2 0	14.7 0	0 0	0 2573.6	0 0
INPUT 2	1250.0 0	100.00 0	1250.0 0	-0.0 0	1250.0 0	1250.0 0	1250.0 0	0 0	0 0	0 0	0 0	100.0 0	100.0 0	0 0	0 0	0 0
OUTPUT 2	20000 0	3.00 0	10.000 0	-0.0 0	100.0 0	25.0 0	50.000 0	0 0	0 0	0 0	0 0	373.2 0	114.7 0	0 0	0 0.0	0 0
UNITS	R	M	W	P	P	P	K									

FNCTN	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
INPUT 1	60.000	10.0	50.000	0	0	0	0	0	0	0	0	0	0	0	0	0
OUTPUT 1	1.00	1.0	8.33	0	0	0	0	0	0	0	0	0	0	0	0	0
INTERVAL	1440	1440	1440	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITS	M	P	K													

FIGURE 26. SAMPLE PROGRAM PRINTOUT — USER-DEFINED FUNCTIONS

RUN MODE PROGRAMMING

GENERAL INFORMATION

In order to provide flexibility during data monitoring operations, the Digistrip III has been specially designed to accept certain program changes while operating in the RUN mode. These special Run Mode Programming operations are:

- Alarm Limits Changes
- Time Interval Changes (Print, External Transmission and Math Intervals)
- Automatic Calibrations
- Redefinable Constants

Whenever Run Mode Programming operations are to be conducted, the Configuration Numbers must be appropriately defined (see Tables 1 through 4). In particular, Digit 6 of Configuration Number 1 must be defined as 1, 3, 5 or 7, and Digit 6 of Configuration Number 3 must be defined as 0, 1 4 or 5. When conducting Run Mode Programming, the automatic Alarm Search feature must be disabled (Auto Search indicator lamp not lighted).

To restore normal RUN mode data displays after conducting Run Mode Programming, press the key labeled CHANNEL/ALARM SEARCH one time. Data displays may then be called up in the normal manner.

The following subsections describe each of the Run Mode Programming operations.

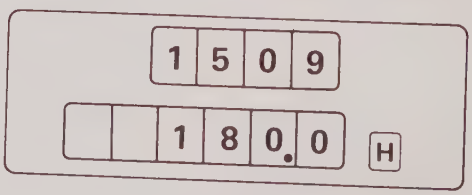
ALARM LIMITS CHANGES

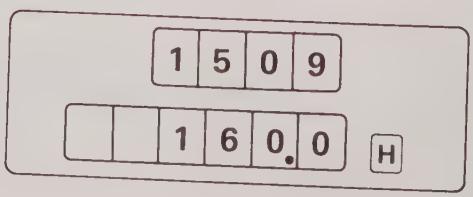
When this feature is enabled, any defined Alarm Limit may be changed during RUN mode operation by appropriate keying procedures. Alarm Limits Changes are programmed in much the same manner as Alarm Limits (see page 55). To change an Alarm Limit during RUN mode operation, first access the defined limit, then key in the new limit value and press ENTER.

The following example shows the keying sequences and displays involved in changing a High Alarm Limit (Limit 1) for Function 09 assigned to Channel Address 509. The limit is to be changed from 180.0 to 160.0.

When these sequences are keyed in the order shown . . .

. . . these displays will appear



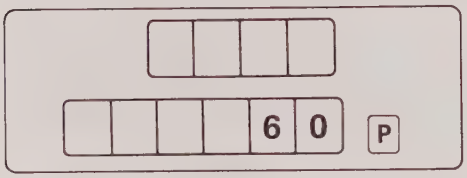


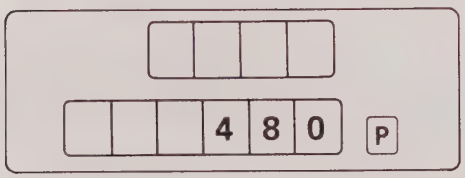
TIME INTERVAL CHANGES

When this feature is enabled, the defined Print Interval, External Transmission Interval and/or Math Interval may be changed while the instrument is operating in the RUN mode. Time interval changes are programmed in much the same manner as time intervals (see page 62). To change any one of the time intervals during RUN mode operation, press the TIME INTERVAL key one, two or three times to access the desired Print Interval (P), External Transmission Interval (X) or Math Interval (M). Once the desired time interval is accessed, key in the new interval value and press ENTER.

The following example shows the keying sequence and displays involved in changing the Print Interval from 60 minutes (1 hour) to 480 minutes (8 hours).

These displays will appear . . . **. . . when this sequence is keyed in the order shown**





AUTOMATIC CALIBRATION

When the Automatic Calibration feature is enabled, the input from any sensor may be calibrated while the instrument is operating in RUN mode. This feature is used when high accuracy measurements are required, or when automatic zero corrections are desired on current transmitters, strain gages, etc.

Automatic calibration requires the use of two Channel Addresses. The first address is used to measure inputs from the sensor. The appropriate measurement function (e.g., Function 09 for a Type T thermocouple) is assigned to this first location. The second address is used to determine the calibrated value. A linear function is assigned to the second location, with the Channel Address of the sensor input specified as its Source Code.

Once the linear function is assigned and its Source Code specified, Input and Output values must be defined for two known calibration points on the curve. These values are known as Input 1, Output 1, Input 2 and Output 2. Figure 27 shows the two known calibration points.

As the Automatic Calibration feature is normally applied, the Input and Output values of each point are initially defined on a one-to-one basis. For example, Input 1 and Output 1 might both be defined as 0.0, while Input 2 and Output 2 are defined as 100.0. Whenever a curve calibration is desired, one or both of the Inputs must be changed.

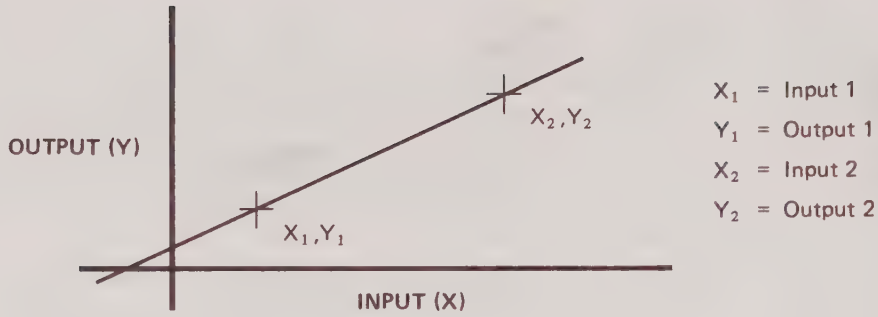


FIGURE 27. KNOWN CALIBRATION POINTS

Automatic Calibrations may be carried out on either a single known calibration point (Input 1 *or* Input 2), or two known points (Input 1 *and* Input 2). In both cases, the defined Output values do not change, and corrections are applied to the Inputs such that the corrected Inputs are the proper values for the specified Outputs.

Input 1 Calibration

The automatic Input 1 calibration is used for zero corrections only. Using this technique, whenever the value of Input 1 is changed, Input 2 is automatically changed by the same amount. This action results in a shift in the position of the curve without changing its slope. Figure 28 shows the effect of an automatic Input 1 calibration.

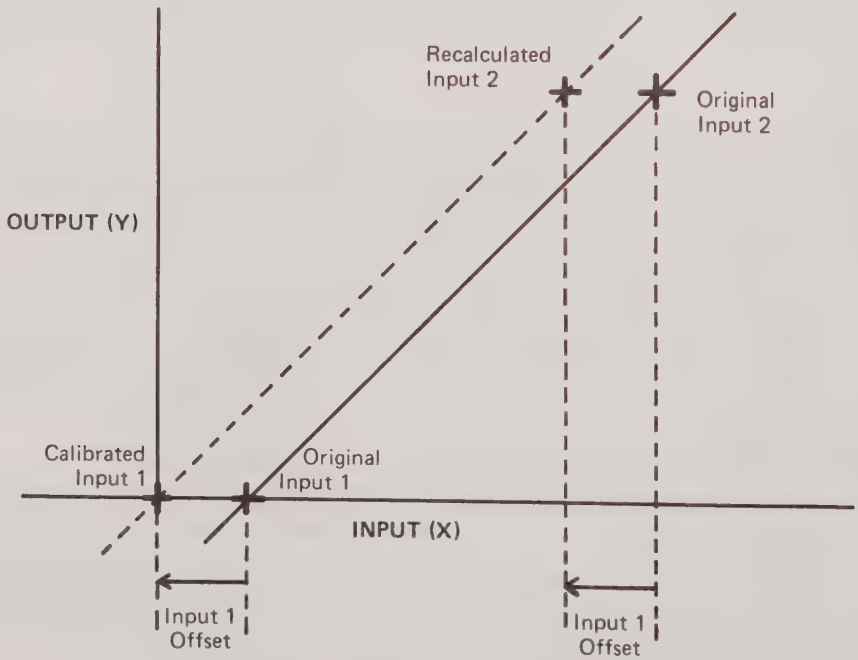


FIGURE 28. INPUT 1 CALIBRATION

Input 1 and Input 2 Calibration

When a combined span and zero correction is desired, both Input 1 and Input 2 must be calibrated. The automatic two-point calibration technique changes both the slope and X and Y intercepts of the curve. In order to calibrate Inputs 1 and 2, accurate reference values must be available for both known points. Figure 29 shows the effects of the combined Input 1 and Input 2 calibration. Changing Input 1 always changes Input 2 by the same amount, but changing Input 2 has no effect on Input 1. Therefore, when performing a two-point calibration, *always* calibrate Input 1 first and Input 2 second.

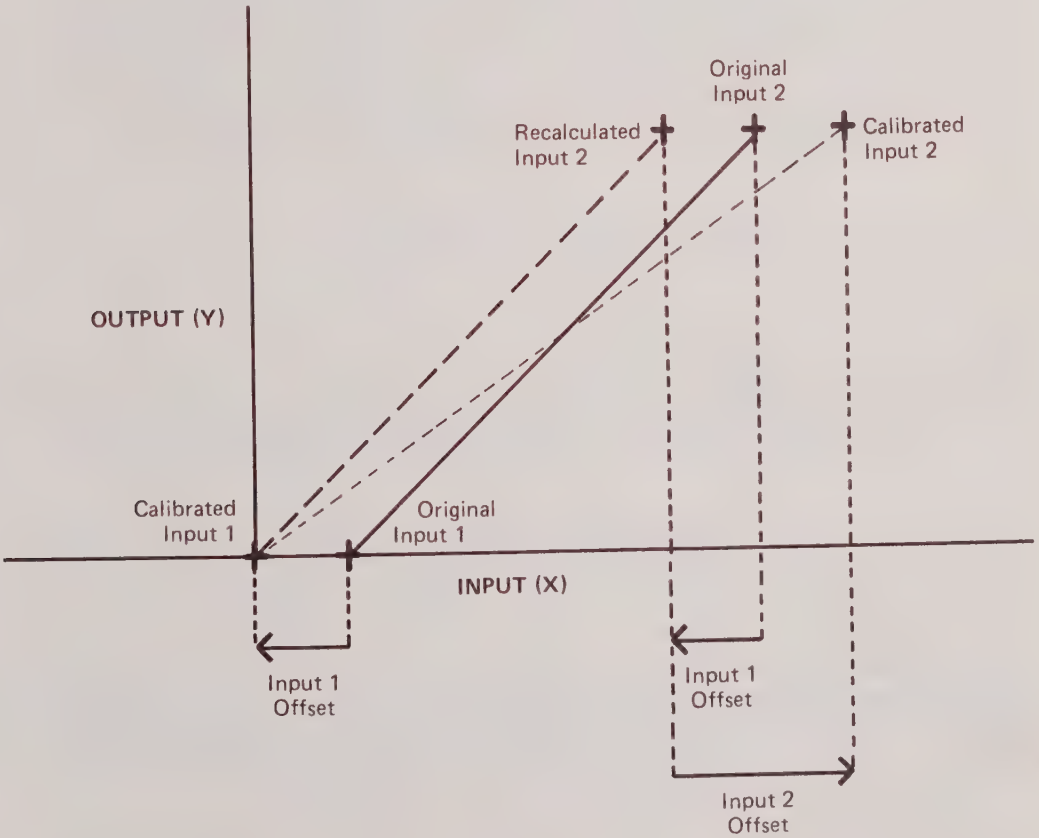


FIGURE 29. INPUT 1 AND INPUT 2 CALIBRATION
(showing negative Input 1 offset and positive Input 2 offset)

Input 2 Calibration

In some applications, Input 2 *only* may be calibrated while Input 1 remains unchanged. This calibration is used to correct span errors in applications where Input 1 cannot conveniently be calibrated. The net effect of the automatic Input 2 calibration is to pivot the slope of the curve on the point defined by Input 1. The Input 2 calibration is diagrammed in Figure 30.

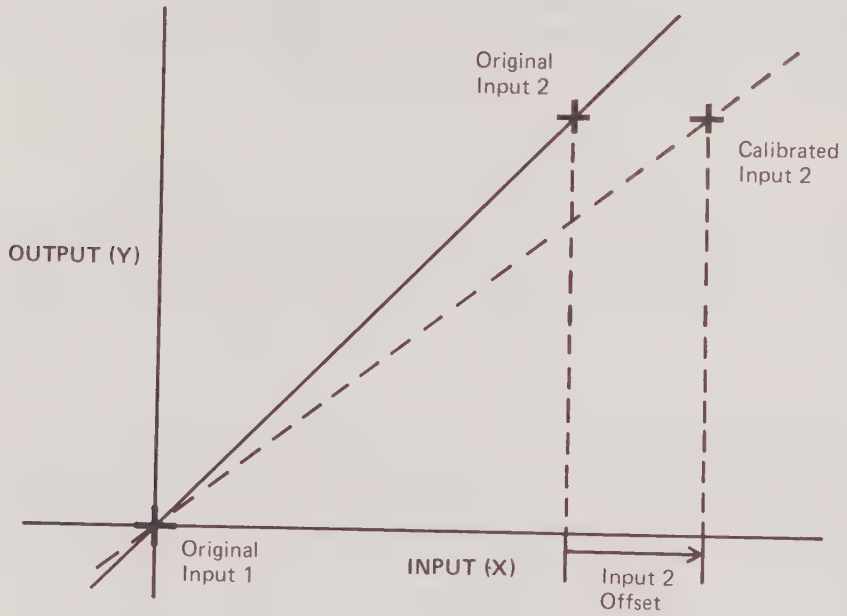


FIGURE 30. INPUT 2 CALIBRATION

Automatic Calibration Procedure

In order to conduct Automatic Calibrations on inputs from a sensor, certain procedures must be followed. These procedures involve defining the operation in the PROGRAM mode and doing the actual calibration in the RUN mode. The following paragraphs describe these procedures.

In PROGRAM Mode . . .

With the instrument operating in PROGRAM mode, first make sure that the Configuration numbers are appropriately defined to facilitate the desired operations. In particular, these numbers must be defined to allow (1) Automatic Calibration in RUN mode, and (2) RUN mode operation of the right half of the keyboard. These features are selected by defining Digit 6 of Configuration Number 1 to be 1, 3, 5 or 7, and Digit 6 of Configuration Number 3 to be 0, 1, 4 or 5. Next, connect the sensor input to a particular Channel Address, assign an appropriate measuring function to that location, and specify a Source Code of 000.

Once the uncalibrated input measuring function is assigned, a linear function must be assigned to conduct the calibration. This linear function is assigned to another Channel Address with the input measuring address specified as its Source Code. After assigning the linear function, define its Input 1, Output 1, Input 2 and Output 2 values to correspond to the two known calibration points (see Figure 27). Once this is done, the instrument may be switched to RUN mode operation.

In RUN Mode . . .

With the instrument set in RUN mode and the Alarm Search feature turned off, either Input 1 or Input 2 or both Inputs 1 and 2 of the linear function may be calibrated automatically as described on pages 73 and 74. To calibrate Input 1, set up the sensor such that it is measuring the first known calibration point at the measuring Channel Address. At this point, make sure that the programmed value of the linear function's Output 1 is equal to the actual value of the measured parameter. Next, call up the display of data for the calibration address. Prior to doing the first calibration, the data value of the calibration address will be equal to the uncalibrated value of the source data, unless scaling has been combined with the calibration function.

If, before actual calibration, the data value of the calibration address is equal to that of the source data, there is no need to calibrate Input 1. If these two values are different, however, an Input 1 calibration may be desired.

To calibrate Input 1, call up the calibration Channel Address, then press the FUNCTION INPUT key one time. When this is done, the current value of Input 1 will appear in the lower LED display. At the same time, a "1" will appear in the leftmost position of the upper display to indicate that Input 1 is accessed. If there has been no previous calibration of Input 1, its value will be the programmed value.

Once Input 1 has been called up, press the CHANGE key. This action will cause the current uncalibrated source data value to appear in the lower display. Finally, press the ENTER key to enter the difference between the current uncalibrated source data value and the programmed Input 1 value into the function's memory. This difference is then automatically added to (or subtracted from) the programmed Input 1 value to give a calibrated Input 1 value for the curve.

Once Input 1 has been calibrated, the current value of its uncalibrated source data will produce the desired Output 1 value at the calibration address. This can be verified by pressing the CHANNEL key and returning to the normal data display mode.

Input 2 is calibrated in the same manner as Input 1. To access Input 2, press the FUNCTION INPUT key a second time.

A single linear function may be assigned to calibrate a series of inputs of the same type (e.g., a series of Type T thermocouples). When this is done, the Input 1, Output 1, Input 2 and Output 2 values of the function will be the same for all assigned locations, while the Source Codes differ. Calibrations of the Input values, however, will be done on an individual location basis.

Automatic Calibration Examples

Example 1 — Input 1 Calibration

A plant engineer wishes to use a Digistrip III to calibrate a 0-30 psig pressure transducer with an output range of 0-15 mv. Although he has no convenient means for calibrating its span, he may calibrate the zero point by conducting an Input 1 calibration on an atmospheric pressure measurement.

In order to do this, he sets up the transducer to measure atmospheric pressure and connects its lead wires to the input terminals assigned to Channel Address 201. Next, with the instrument set in PROGRAM mode, he assigns Linear Function 14 to Channel Address 201 and specifies its Source Code to be 000. This function will act as the measuring function. Finally, he defines the operating parameters of Function 14 to be:

Input 1 = 0.000
Input 2 = 15.000
Output 1 = 0.00
Output 2 = 30.00
Units = P (psig)

To provide for RUN mode calibration of the transducer output, he assigns Linear Function 15 to Channel Address 301 and specifies its Source Code to be 201 (the transducer output measuring location). The operating parameters of this calibration function are defined to be:

Input 1 = 0.00
Input 2 = 30.00
Output 1 = 0.00
Output 2 = 30.00
Units = P (psig)

Having defined the measuring and calibration functions in this way, he then switches the instrument to RUN mode and calls up the programmed Input 1 value of Channel Address 301 via the keyboard. This value is displayed as 0.00. Next, by pressing the CHANGE key, he calls up the display of the uncalibrated current data value of Channel Address 301. This value is found to be 0.04 psig. Finally, by pressing the ENTER key, he enters the difference between these two values into the memory of Function 15. This action defines an Input 1 Offset of -0.04.

The Input 1 Offset is automatically subtracted from the programmed values of Inputs 1 and 2, while the programmed values of Outputs 1 and 2 remain unchanged. The new reference points defined by these values provide a calibrated input measurement curve similar to that shown in Figure 28.

Example 2 — Input 1 and Input 2 Calibration

A pharmaceutical manufacturer wishes to conduct a two-point calibration on a Type T thermocouple to be used in steam sterilization monitoring. The two known reference points are 0°C and 121.1°C.

To accomplish the calibration, the operator connects the thermocouple lead wires to the input terminals assigned to Channel Address 216. Following this, he places the thermocouple sensor at 0°C in a Kaye Model K140-4 Ice Point Reference.

With the instrument set in PROGRAM mode, he assigns thermocouple measuring Function 09 to Channel Address 216 and specifies its Source Code to be 000. Then, to provide for RUN mode calibration of the thermocouple output, he assigns Linear Function 35 to Channel Address 316 and specifies its Source Code to be 216 (the thermocouple measuring location). The operating parameters for Function 35 are defined as follows:

Input 1 = 0.0
Input 2 = 121.1
Output 1 = 0.0
Output 2 = 121.1
Units = C (° Celsius)

Having defined the measuring and calibration functions in this way, the operator then switches the instrument to RUN mode and calls up the programmed Input 1 value of Channel Address 316 via the keyboard. This value is displayed as 0.0. Next, by pressing the CHANGE key, he calls up the display of the uncalibrated current data value of Channel Address 316. This value is found to be 0.5°C. Finally, by pressing the ENTER key, he enters the difference between these two values into the memory of Function 35. This action defines an Input 1 Offset of -0.5.

Once the Input 1 Offset has been defined, the thermocouple sensor is removed from the ice point reference and placed at 121.1°C in a Kaye Model HTR-150 High Temperature Reference. After allowing the system to stabilize, the operator calls up the programmed Input 2 value of Channel Address 316. This value is displayed as 121.1. Next, by pressing the CHANGE key, he calls up the display of the uncalibrated current data value of Channel Address 316. Its value is now found to be 120.8°C. Finally, by pressing the ENTER key, he enters the difference between these two values into the memory of Function 35. This action defines an Input 2 Offset of 0.3.

The Input 1 and Input 2 Offsets of Function 35 define a calibrated curve for the thermocouple linearization. The curve shift described in this example is similar to the one shown in the diagram of Figure 29.

Example 3 — Input 2 Calibration

A plant engineer wishes to use a Digistrip III to calibrate the fill volume measurement scale of a never-empty 5000-gallon capacity upright cylindrical bulk storage tank. The fill level is measured by a pressure transducer located at the bottom of the tank. This transducer is rated to produce a 1-5 V (1000-5000 mv) output over the 0-5000-gallon fill volume range. Since the tank is never empty, the only reference point available for calibration is the capacity fill level. An Input 2 calibration will be used to calibrate this reference point.

In order to do the calibration, the engineer first has the tank filled to capacity, then connects the transducer lead wires to the input terminals assigned to Channel Address 109. Next, with the instrument set in PROGRAM mode, he assigns Linear Function 20 to Channel Address 109 and specifies its Source Code to be 000. This function will act as the measuring function. Finally, he defines the operating parameters of Function 20 to be:

Input 1 = 1000.0
Input 2 = 5000.0
Output 1 = 0.0
Output 2 = 5000.0
Units = G (gallons)

To provide for RUN mode calibration of the transducer output, he assigns Linear Function 21 to Channel Address 209 and specifies its Source Code to be 109 (the transducer output measuring location). The operating parameters for this calibration function are defined to be:

Input 1 = 0.0
Input 2 = 5000.0
Output 1 = 0.0
Output 2 = 5000.0
Units = G (gallons)

Having defined the measuring and calibration functions in this way, he then switches the instrument to RUN mode and calls up the programmed Input 2 value of Channel Address 209 via the keyboard. This value is displayed as 5000.0. Next, by pressing the CHANGE key, he calls up the display of the uncalibrated current data value of Channel Address 209. This value is found to be 4952.5 gallons. Finally, by pressing the ENTER key, he enters the difference between these two values into the memory of Function 21. This action defines an Input 2 Offset of 47.5.

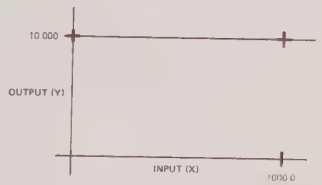
The Input 2 Offset defines a calibrated Input 2 value, while leaving the programmed values of Input 1, Output 1 and Output 2 unchanged. The effect of this operation is to define a calibrated measurement curve similar to that shown in the diagram of Figure 30.

REDEFINABLE CONSTANTS

Certain applications require the use of input Constants that can be adjusted to reflect variable conditions such as the changing heat output values for various fuels in boiler efficiency monitoring. To meet this need, a technique is provided for programming redefinable Constants in RUN mode. When programmed as described below, the value of a Constant may be redefined at any time via the keyboard. An important feature of this technique is that it permits the redefinition of Constants without disturbing the on-line monitoring operation of the unit.

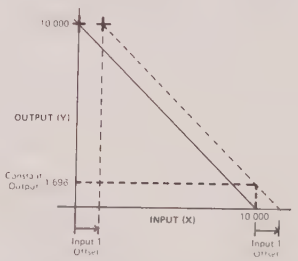
When a Constant is to be defined in RUN mode, the framework for this operation must first be defined in PROGRAM mode. To do this, first assign a linear function to an unused Channel Address and specify its Source Code to be 901 (an always active internal information storage location). Define the Input and Output values of this function to provide a constant output of 10000 counts (i.e., Outputs 1 and 2 both defined as 10000). The decimal point in Inputs 1 and 2 should be placed in the XXXX.X position, while the decimal point in Outputs 1 and 2 should be positioned as it will appear in the Redefinable Constant. For example, if the Constant is to have a resolution of XX.XXX, the Input and Output values of this function should be defined as:

Input 1 = 0000.0
Input 2 = 1000.0
Output 1 = 10.000
Output 2 = 10.000



After defining the linear function having a 10000 count fixed output, define a second linear function to the Channel Address where the Redefinable Constant is to be located. Specify the Source Code of this function to be the Channel Address of the fixed output function. This second linear function will provide for the definition of the Constant. Define the Input and Output values of this function to provide a slope of -1, with the decimal point in these values located where it will appear in the Redefinable Constant. For example, for a Constant with a resolution of XX.XXX, the Input and Output values for this second linear function will be defined as:

Input 1 = 00.000
Input 2 = 10.000
Output 1 = 10.000
Output 2 = 00.000



Finally, with the instrument set in RUN mode, redefine Input 1 of the second linear function to be the Constant value desired, excluding the decimal point. For example, for a Constant of 1.696, press the FUNCTION INPUT key, enter the number 01696, then press the ENTER key. When the Constant is entered in this way, the decimal point will be assigned automatically to the location specified in PROGRAM mode. Once the Constant is entered, it will be available for use as an input to other functions.

Having defined a Constant in this manner, its value may be redefined in RUN mode at any time by simply entering a new value for Input 1 of the second linear function.

OPTIONAL EQUIPMENT

Kaye Instruments provides a series of modular equipment options for use with the Digistrip III. These options include:

- V-1510 High Accuracy Thermocouple Terminal Extension Assembly
- AO-16 Analog Output Module
- RAMP/Scanner
- CPL Cassette Program Loader
- FS-8 Frequency Scanner
- DS-8 Digital Scanner
- RD-48 Relay Driver
- RC-8R Relay Closure Module
- BC-8 Custom Bridge Conditioner
- BC-8SSG 120 and 350 Ohm Strain Gage Bridge Conditioner
- VD-100 Voltage Divider
- HTR-150 and HTR-300 High Temperature References
- K140-4, K150 and K170 Ice Point References
- 373 RTD Monitor

By adding one or more of these options to a basic Digistrip III system, the operating capabilities of the system may be greatly expanded. For more information on this equipment, contact Kaye Instruments or your local representative.

DIGISTRIP III PROGRAMMING FORM

HEADERS, FUNCTIONS, CONFIGURATION NUMBERS AND TIME INTERVALS

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
HEADER 900																
HEADER 100																
HEADER 200																
HEADER 300																
HEADER 400																
HEADER 500																
HEADER 600																
HEADER 700																
HEADER 800																
FUNCTION																
100																
200																
300																
400																
500																
600																
700																
800																

CONFIGURATION NUMBERS

CONFIGURATION NUMBER 1						
CONFIGURATION NUMBER 2						
CONFIGURATION NUMBER 3						
CONFIGURATION NUMBER 4						

TIME INTERVALS (MINUTES)

PRINT INTERVAL (P) _____

EXTERNAL TRANSMISSION INTERVAL (X) _____

MATH INTERVAL (M) _____

DIGISTRIP III PROGRAMMING FORM

FUNCTION PARAMETERS

USER-DEFINABLE LINEAR FUNCTIONS

FUNCTION NO.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
INPUT 1																
INPUT 2																
OUTPUT 1																
OUTPUT 2																
UNITS ID																

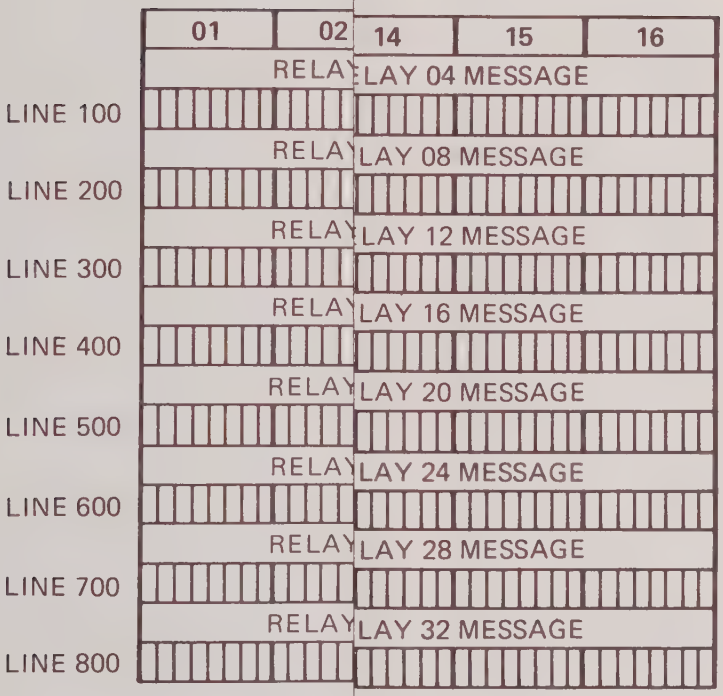
FUNCTION NO.	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
INPUT 1																
INPUT 2																
OUTPUT 1																
OUTPUT 2																
UNITS ID																

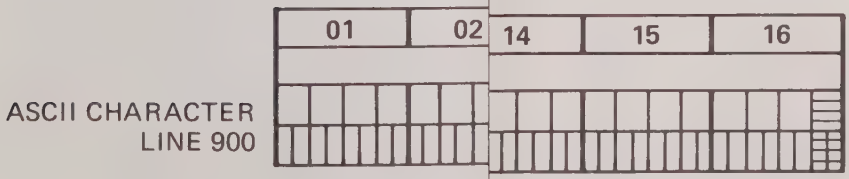
USER-DEFINABLE ACCUMULATION FUNCTIONS

FUNCTION NO.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
ACCUM INTERVAL																
INPUT 1																
OUTPUT 1																
UNITS ID																

*INPUT 2																
*OUTPUT 2																

* Input 2 and Output 2 values are never defined for Accumulation Functions. Values may be assinged to these memory locations, however, in conjunction with Functions 96, 97 and 98.


01
02
14
15
16
RELAY 04 MESSAGE
LINE 100
RELAY 08 MESSAGE
LINE 200
RELAY 12 MESSAGE
LINE 300
RELAY 16 MESSAGE
LINE 400
RELAY 20 MESSAGE
LINE 500
RELAY 24 MESSAGE
LINE 600
RELAY 28 MESSAGE
LINE 700
RELAY 32 MESSAGE
LINE 800


01
02
14
15
16
ASCII CHARACTER
LINE 900

MING FORM

AYS

	09	10	11	12	13	14	15	16

KAYE INSTRUMENTS, INC. 15 DE ANGELO DRIVE BEDFORD, MA 01730 617/275-0300 TWX 710-326-1598

DIGISTRIP III
USER'S GUIDE SUPPLEMENT

KAYE
INSTRUMENTS

KAYE INSTRUMENTS

Document No M4114

DIGISTRIP III
USER'S GUIDE SUPPLEMENT

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SECTION 1 - SPECIFICATIONS AND WARRANTY

1.1 Specifications

Dimensions:	Standard: 49.3cm wide x 31.1cm high x 51.4cm deep (19.0in. wide x 12.2in. high x 20.2in. deep) High Accuracy: 49.3cm wide x 31.1cm high x 57.7cm deep (19.0in. wide x 12.2in. high x 22.7in. deep)
Weight:	Standard: 28.2 Kg (62 lbs) High Accuracy: 31.8 Kg (70 lbs)
Input Voltage:	90-135 VAC (50/60 Hz), or 200-270 VAC (50/60)
Power Consumption:	60W (idling) 130W (printing)
Fuse:	1.5A Slo-Blo (90-135 VAC) 0.75A Slo-Blo (200-270 VAC)
Environmental:	0-50°C (32-125°F) Temperature Range 0-95% Relative Humidity (non-condensing)
Input Channel Capacity:	One, two or three 16-channel groups (maximum 48 channels) in basic instrument; expandable to 128 channels when used with remote scanner
Scanning Rate:	Eight channels per second in basic unit; higher effective rate when used with remote scanner
Input Impedance:	$>10^9\Omega$ after filter has settled. Source impedance should be $<2K\Omega$ for proper filter settling

Common Mode Rejection: (1KΩ Source Imbalance)	140db for DC 130db at line frequency 120db from line frequency to 100 KHz
Maximum Common Mode Voltage:	170 Volts peak (AC or DC) from channel to chassis ground and from channel to channel
Normal Mode Rejection:	60db (50/60 Hz)
Accuracy of Voltage Inputs:	±(0.003% reading + 1 count + 2μV) 30 days ±(0.006% reading + 1 count + 2μV) 1 year
Resolution:	1:65,535
Sensitivity:	0.5μV (on most sensitive range)
Voltage Temperature Coefficient:	±(0.001% reading + 0.1μV)/°C
Compensator Temperature Coefficient:	±0.02°C/°C
Temperature Non-Uniformity of Input Terminals:	Standard: ±0.3°C High Accuracy: ±0.05°C
Standard Functions:	Voltage Functions: 65mv, 650mv, 6.5V Thermocouple Functions: Types E,J,K,R,S,T (°C or °F, with internal ice point reference) Platinum RTD Functions: 100Ω in 1 ma current loop 100Ω in bridge configuration
User-Definable Functions:	32 linear functions 16 accumulation functions

Math Functions:	Interval average, interval maximum, interval minimum, change per minute, group average, group maximum, group minimum, transfer, square root, natural log, exponential, sine, cosine, tangent, inverse sine, inverse cosine, inverse tangent, addition, subtraction, multiplication, division, fourth order polynomial, compressible gas flow, relative humidity, equivalent sterilization time (ΔF), rolling average, rolling maximum and rolling minimum.
Special Order Option:	Deletes 0.01°C Type T thermocouple function and ΔF function; adds type N (Nicrosil/Nisil) thermocouple function and a function to compute fill volume of horizontally mounted cylindrical and elliptical tanks.
Channel Skip:	Individually programmable
Assignable Limits:	Two per channel; independently assignable
Limit Types:	High, Low, Rate-of-Change
Relay Closures:	Two assignable relays; assigned by Odd or Even relay address. Option provides up to 48 additional relays.
Relay Contact Configuration:	Form 1C, normally energized or normally de-energized
Relay Contact Capacity:	4A; 250 VAC resistive load
Time Intervals:	Print Interval, External Transmission Interval and Math Interval - all independently assigned. Programmable range 1 to 19999 minutes. A defined Time Interval of zero causes the operation to occur every 10 seconds.
Printer Type:	5x7 dot matrix, bidirectional printing on 137 column pressure-sensitive fanfold paper; internal paper takeup tray.

Printed Headers:	Nine line programmable data field; 128 alphanumeric characters per line (8 character positions per column). Additional line provides date and column numbers.
Printed Data Capacity:	96,000 channel data printouts per 150 page paper pack
Serial Interface:	RS232C and 20ma TTY current loop (passive)
Serial Interface Connectors:	Screw terminals
Alarm Message Printout:	32 programmable alarm messages

1.2 Analog Input Range and Accuracy Specifications

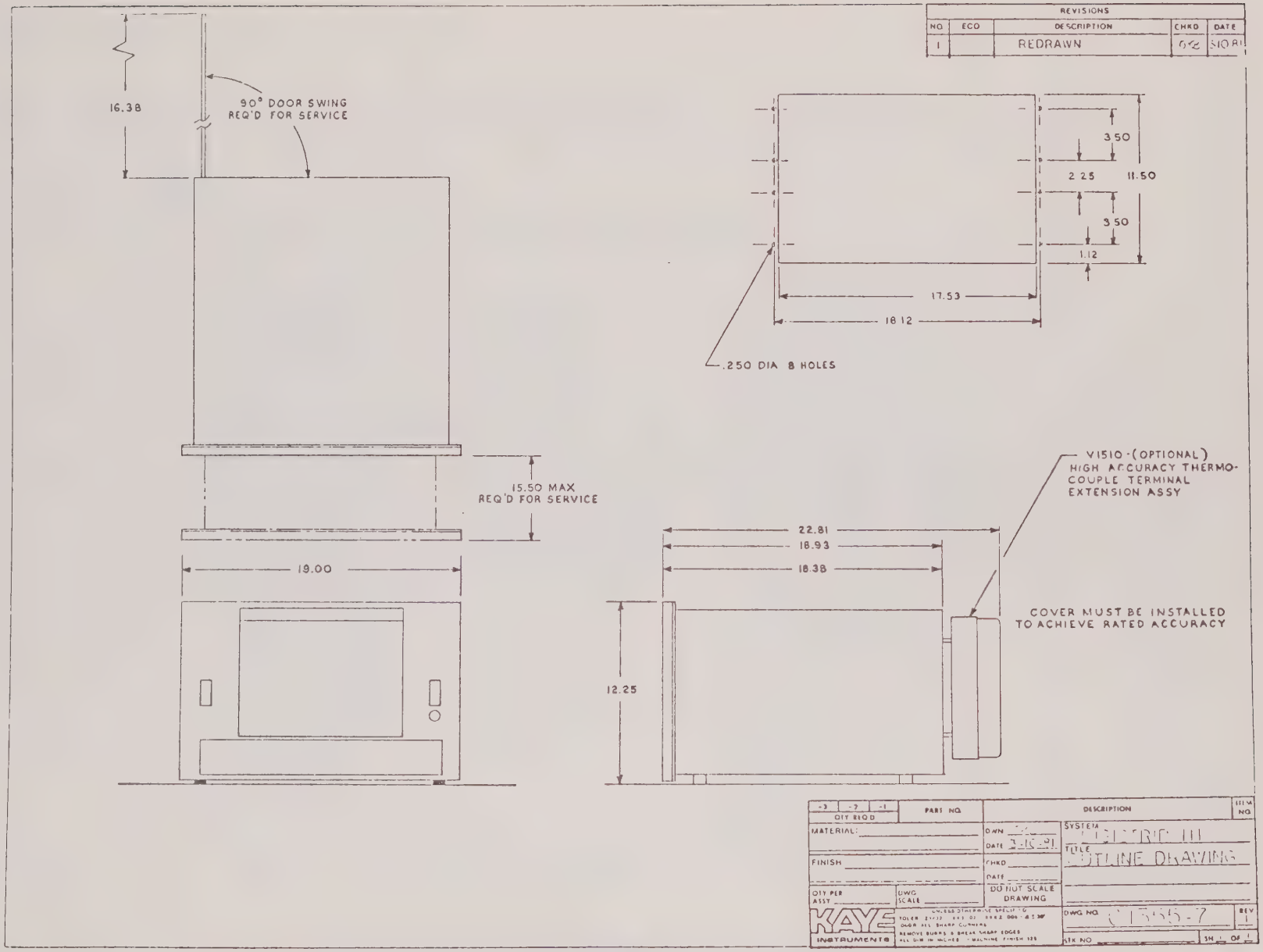
Input Types	Range	Conformity to NBS	Accuracy-Standard	Accuracy-High Accuracy
Voltage	32mv*, 65mv 650mv, 6500mv (6.5V)		±(0.003% reading+1 count + 2μV)	±(0.003% reading +1 count + 2μV)
Thermocouple, Type E	-109C to 858C (-164F to 1576F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type J	-112C to 1130C (-170F to 2066F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type K	-137C to 1392C (-215F to 2537F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type R	-21C to 1779C (-5F to 3234F)	0.1C above 260C 20.0C below 260C	±(0.003% reading+0.9C)**	±(0.003% reading+0.65C)**
Thermocouple, Type S	-21C to 1767C (-5F to 3212F)	0.1C above 260C 20.0C below 260C	±(0.003% reading+0.9C)**	±(0.003% reading+0.65C)**
Thermocouple, Type T	-220C to 402C (-364F to 755F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type T	-112C to 341C	0.02C	±(0.003% reading+0.45C)	±(0.003% reading+0.20C)
RTD, 100Ω Pt. 1ma	-128C to 855C (-198F to 1571F)	0.06C***	±(0.003% reading+0.1C)	±(0.003% reading+0.1C)
RTD, 100Ω Pt. bridge	-125C to 808C (-193F to 1487F)	0.06C***	±(0.003% reading+0.1C)	±(0.003% reading+0.1C)

* 32mv range used for Thermocouple Types R, S and T measurements only
** Accuracy specification for temperatures above 260C
*** Conformity to DIN43760

System accuracy includes all instrument errors including maximum conformity deviations, reference junction compensation with worst case thermal scatter of input terminals, long term drift, temperature coefficients, A/D conversion errors, and scanner errors. System accuracy, 30 days 20C to 30C ambient.

The AUTO CAL feature permits users to substantially improve the above listed accuracy figures by eliminating both sensor and system based thermal scatter effects.

1.3 Outline Drawing



1.4 Warranty

Kaye Instruments equipment is warranted free from manufacturing and material defects for a period of one year after delivery. Any equipment purchased from Kaye Instruments which becomes defective during this period will be repaired or replaced at the site of the customer or at the Kaye plant in Bedford, Massachusetts. The site of such repair shall be determined by Kaye Instruments. The only exception to this warranty is equipment such as a magnetic tape recorder, a paper tape punch, a computer or other equipment which is used in conjunction with a Kaye system, but is not a standard Kaye Instruments product. Such equipment will be warranted for a period of 30 days by Kaye Instruments if it is purchased from Kaye as part of a system. Warranty for a longer period may be provided by the manufacturer of the equipment.

Equipment returned to the Kaye plant for repair must have shipping charges prepaid and must be accompanied by documentation explaining the reason for return. Please obtain return authorization from Kaye's Service Department prior to returning any equipment for repair.

Kaye Instruments reserves the right to make changes or improvements in its products without incurring any obligation with respect to products previously manufactured. All warranties are contingent upon proper use in the application for which the products were intended and do not cover products which have been modified without Kaye Instruments' approval or which have been subjected to unusual physical or electrical stress.

Except for the express warranty set forth above, Kaye Instruments grants no warranties, either expressed or implied, on products, and the stated express warranty is in lieu of all liabilities or obligations of Kaye Instruments for damages including, but not limited to, consequential damages occuring out of or in connection with the use or performance of Kaye Instruments products.

SECTION 2 - CALIBRATION

2.1 Introduction

All Digistrip III process monitors are fully calibrated by Kaye Instruments prior to shipment. These instruments normally need no further adjustment or calibration at the time of initial installation. To assure continued accuracy, however, certain adjustments must be made periodically.

Under normal operating conditions, each Digistrip III should be checked-out and recalibrated at least once each year. When high accuracy measurements are being made, more frequent calibration may be required. In addition, recalibration is sometimes required when instrument service is performed (e.g. replacement or addition of a circuit board, etc.)

Complete calibration of a Digistrip III involves three basic operations; these operations are:

- Analog Board Calibration
- Zero Width Adjustment
- Reference RTD Calibration

2.2 Analog Board Calibration

The Digistrip III's Analog circuit board (part #U0920) acts as a digital voltmeter. This board is mounted inside of the cabinet rear door.

All Analog boards are calibrated by Kaye Instruments prior to shipment; these boards normally require no further calibration at the time of initial installation. Analog boards in existing Digistrip III systems, however, should be calibrated at least once each year. Calibration of these boards should always be done before any other Digistrip III calibrations.

Materials Required

High quality, laboratory grade potentiometer or precision voltage source, such as EDC Model E100.

Phillips screwdriver

Small screwdriver

Calibration Procedure

1. With the instrument power switched ON, remove the four rear door securing screws and open the Digistrip III's rear door. With the rear door open, the Analog board will be visible behind a black metal heat shield on the rear bulkhead.

2. Note the positions of potentiometers P1-P5 along the right edge of the Analog board; the calibrating adjustments will be made using these potentiometers.

3. When familiar with the positions of P1-P5, close the rear door and allow the instrument to temperature stabilize. Temperature stabilization usually takes approximately 30-45 minutes from power ON.

4. Hook-up the precision voltage source to the input connectors of an appropriate channel (e.g. channel 101).

5. Once the Digistrip III has temperature stabilized, conduct adjustment steps 1-5 as described in the following table.

ANALOG BOARD CALIBRATION

Adjustment Step	Channel Function Assigned	Control to be Adjusted	Precision Input Voltage	Reading After Adjustment
1	03	P1	+6000.0mv	6000.0M (±0.3mv)
2	03	P2	-6000.0mv	-6000.0M (±0.3mv)
3	02	P3	+600.00mv	600.00M (±0.03mv)
4	01	P4	+60.000mv	60.000M (±0.006mv)
5	13	P5	+30.000mv	6.0000 (±0.0015mv)

Note: This table gives the order of adjustments, the function number required to set the DVM range, the name of the control to be adjusted, and the input voltage and required output readings. The calibration order is important because the first and second adjustments each directly affect all the adjustments which follow. Also, since thermal stability is important to the accuracy of this calibration, the rear door of the Digistrip III should be kept closed between potentiometer adjustments.

2.3 Zero Width Adjustment

The Zero Width adjustment of a Digistrip III is necessary because of electronic delays within the DVM. These delays result in minor inaccuracies in count values. The Zero Width varies from one analog board to another and must always be compensated for when making accurate measurements. Compensation for an analog board's Zero Width is made by the appropriate setting of the DIP switch slides on the Data Acquisition board.

The Zero Width compensating adjustment of all Digistrip III systems is made by Kaye Instruments at the time of manufacture. Since the Zero Width value of an analog board does not vary significantly, subsequent adjust is not normally required. Adjustment is required only if the analog board or data acquisition board is changed.

Note: The Zero Width adjustment is difficult to perform and should only be attempted by qualified service personnel.

Materials Required

A high quality, laboratory grade potentiometer or precision voltage source, such as the EDC Model E100.

Adjustment Procedure

1. Turn the Digistrip III power switch ON and define function 03 (6.5 V range) for channel 101.

2. Attach the lead wires from the precision voltage source to the channel 101 input terminals.

3. Open the Digistrip III's front door and slide the chassis forward. When doing this, take precautions to assure that the instrument does not tilt forward.

4. Using the Digistrip III's keyboard, call up channel 904 and note the value displayed (e.g. 2.3 mv).

   Note: Channel 904 has a shorted input. Its reading denotes the DVM's auto-zero offset value for the 6.5 V range.

5. Using the precision voltage source set on the millivolt range, apply the same voltage (both magnitude and sign) displayed for channel 904 to channel 101.

6. Call up channel 101 via the keyboard and note the value displayed.

7. Adjust the precision voltage source to add 1.0 mv to the original channel 101 input (e.g. 2.3 mv + 1.0 mv = 3.3 mv) and note the channel 101 value displayed.

8. Readjust the precision voltage source to subtract 1.0 mv from the original channel 101 input (e.g. 2.3 mv -1.0 mv = 1.3 mv) and note the channel 101 value displayed.

9. When the Zero Width is properly adjusted, the Zero Width span between the +1.0 mv and -1.0 mv displayed values should be 2.0 mv (e.g. 3.3 mv -1.3 mv = 2.0 mv. If the displayed span does not equal 2.0 mv, adjustments must be made via the data acquisition board's DIP switch slides #1-7.

10. The Zero Width span adjustment values of the DIP switch slides are cumulative. The values of the various slides are shown in the table below. To increase or decrease the Zero Width span, turn the appropriate slide(s) ON or OFF.

Slide Number	Zero Width Span Adjustment (Approximate mv Value)
1	5.12 mv
2	2.56 mv
3	1.28 mv
4	.64 mv
5	.32 mv
6	.16 mv
7	.08 mv

Note: Changing slide #7 may have little effect; it will change the span by less than 0.1 mv. Any DIP switch slide changed will affect the channel 904 reading by a value approximately equal to that of the slide changed.

11. Repeat steps 4-10 (above) as necessary to achieve a proper Zero Width setting.

2.4 Reference RTD Calibration

Each Digistrip III is equipped with either one, two or three Channel Access boards. These boards are mounted on the instrument's rear door. Each Channel Access board has a 100 ohm platinum RTD positioned inside its isothermal terminal block. Whenever a Digistrip III is used to process thermocouple inputs, the RTDs sense the temperature of the terminal block connectors and provide automatic ice point reference compensation.

All thermocouple reference RTDs are calibrated by Kaye Instruments prior to shipping. They normally require no further calibration upon receipt. Once operational, Digistrip III reference RTDs should be calibrated at least once each year. When high accuracy measurements are being made, more frequent calibration may be required.

Thermocouple reference RTDs normally are calibrated at the ice point, using a Kaye Model K140-4 Ice Point Reference (or crushed ice bath). The calibration procedure is described below.

Materials Required

- Kaye Model K140-4 Ice Point Reference, or a properly made crushed ice bath.*
- Phillips screwdriver
- Small regular screwdriver
- Thermocouple sensor hook-ups

*Preparing an Ice Bath

Material Required: Dewar (vacuum) flask.

Pure water (preferably distilled) for both ice and water.

1. Fill the Dewar flask with crushed or shaved ice. Fill the flask with pure water and allow it to cool to the ice point.

2. Decant some of the liquid from the flask and replace it with shaved or crushed ice. Repeat this procedure until the ice extends to the bottom of the flask. This can be checked by pressing on the top of the ice.

3. The melted water must be periodically drained and replaced with more ice. Failure to do this can result in an error of as much as 4°C, even though ice is still visible in the flask.

Calibration Procedure

1. Turn the Digistrip III's power switch ON and allow the instrument to temperature stabilize for approximately two hours before starting the calibration procedure. Keep the instrument's rear door closed during this period.

2. Prepare the ice point reference (or crushed ice bath) and position it in a convenient location for conducting the thermocouple calibration.

3. Hook up one type E, J, K or T thermocouple to the input terminals of a selected channel in each 16-channel group to be calibrated.

   Note: Thermocouple types R and S are not recommended for this calibration procedure because of their low output level in the ice point range.

4. Remove the retaining screws from the Digistrip's rear door panel (or high accuracy thermocouple input panel).

5. Using the Digistrip III's keyboard, define the appropriate thermocouple function for each test channel. The thermocouple functions are listed in the following table:

Digistrip III Thermocouple Functions

Thermocouple Type	Function Number
Type E	04
Type J	05
Type K	06
Type T	09

6. Place the test thermocouple sensor(s) in the ice point reference (or crushed ice bath) and allow them to temperature stabilize for approximately five minutes.

7. Using the Digistrip III's keyboard, call up the test channel and observe the reading displayed.

8. Open the rear panel of the Digistrip III and locate the adjusting screw on potentiometer P1 of the appropriate channel access board (P1 is mounted on the right edge of the boards).

9. Using a small screwdriver, adjust P1 such that the test channel display reads 0.0°C or 32.0°F, then immediately close the instrument's rear door.

10. To calibrate other channel block RTDs, repeat steps 7 and 9 (above) using the appropriate test channels.

SECTION 3 - SERVICE

3.1 Introduction

Although the Digistrip III is designed to provide long-term reliable operation, occasional component failures may require corrective action. Because most of the components are not user-serviceable, repairs normally are made by exchanging one or more defective circuit board assemblies. To facilitate these exchange procedures, all circuit boards are mounted in easily accessible locations and are easy to exchange. The following subsections provide detailed information on the circuit board exchange procedures, together with information on certain circuit board adjustments.

3.2 V1060 Power Supply Adjustment

The Digistrip III Power Supply (part number V1060) is a tap-switching power source. It is designed to automatically select the proper transformer tap as the input voltage varies over the instrument operating range. All power supplies are factory-adjusted by Kaye Instruments prior to shipping and normally need no further adjustment. If adjustment is needed, however, it may be done according to the procedure described below. The adjustment procedure varies the point on the Power Supply load curve at which the taps switch.

Equipment Required

- Voltmeter (capable of 0.01V resolution on 20VDC range)
- Clip-on voltmeter lead wires
- 5/64" hex key
- 11/32" open-end wrench or small adjustable wrench
- Small screwdriver with insulated shaft

Adjustment Procedure

1. With the Digistrip's Load/Run switch set in the LOAD position, the power switch turned OFF, and the power cord disconnected, open the front door and slide the chassis forward on its rails. Whenever the chassis is slid forward, take precautions to prevent the unit from tipping.

2. Tear off and remove the paper stack from the upper paper tray.

3. Remove the hold-down screws from the front edge of the upper paper tray and lift the tray out of the instrument. With the upper paper tray removed, the Power Supply will be visible inside the chassis.

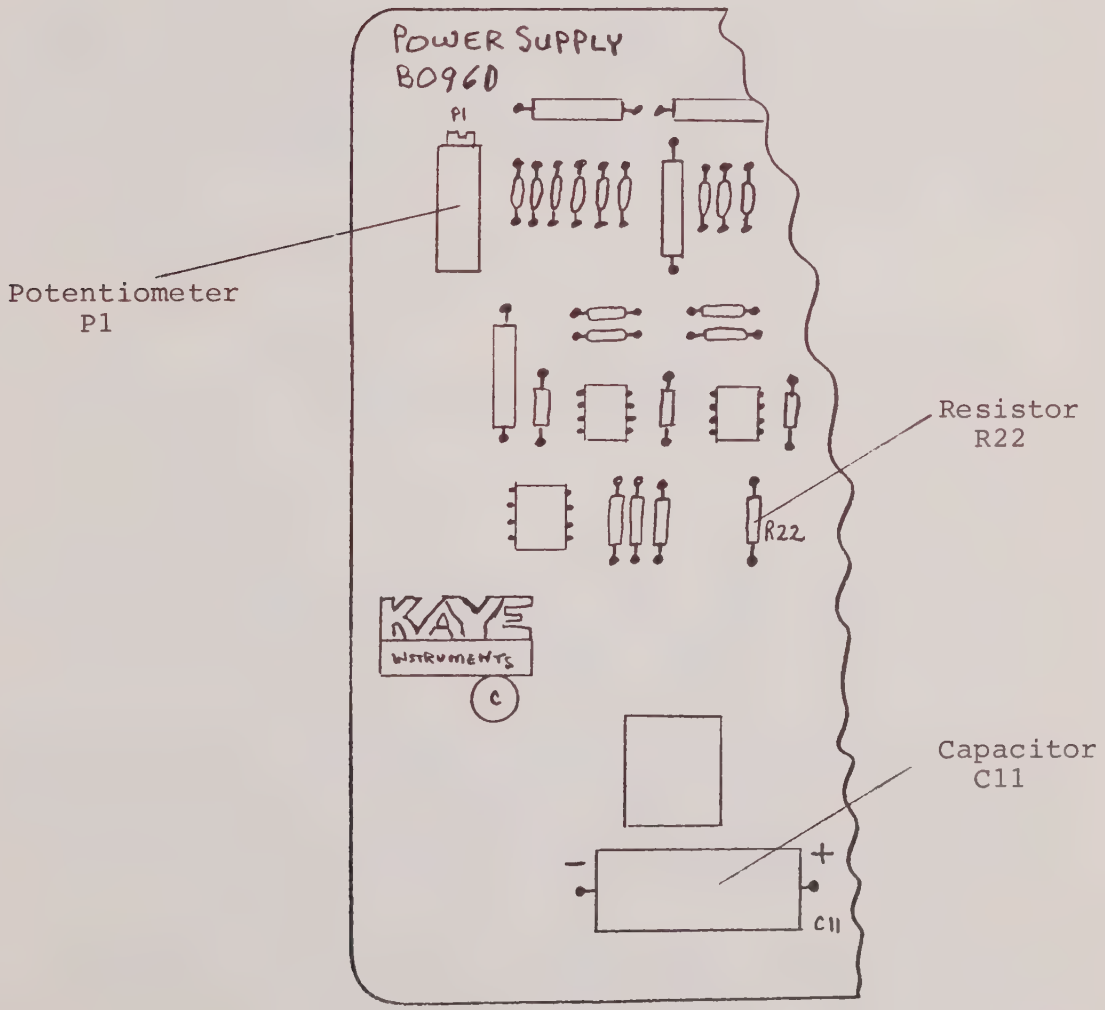
   Caution: The Digistrip power supply contains High Voltage circuits. To preclude possible injury, make sure that the power cord is disconnected before proceeding with steps 4 through 9 below.

4. Remove the three mounting nuts from the power supply base plate and carefully tilt the upper edge of the supply toward the front of the instrument.

5. Examine the Power Supply and locate transformers T1 and T2. When standing in front of the instrument, T1 is the rightmost transformer on the power supply base plate and T2 is the adjacent transformer. A code number is marked on the top of each transformer. T1 and T2 may be present in any one of three code number combinations. The reference voltage used in the

Power Supply adjustment procedure will depend upon the T1 and T2 transformer combination present. Note the code numbers on T1 and T2; this information will be used in step 11 below.

6. With the Power Supply tilted forward, examine the circuit board and locate capacitor C11 and resistor R22. The positions of these components are shown in the diagram below.



7. Position the voltmeter near the Digistrip unit and select the 20VDC range.

8. Clip the voltmeter's red (+) lead wire to the top end of resistor R22 (see diagram).

9. Clip the voltmeter's black (-) lead wire to the negative end of capacitor C11 (see diagram). The negative end of C11 is the end closest to the edge of the circuit board.

10. Connect the Digistrip power cord to a properly grounded electrical outlet and turn the power switch ON.

11. Using the voltmeter, measure the reference voltage between the two test points. Depending upon the T1 and T2 transformer combination present (see step 5 above), the reference voltage for a properly adjusted power supply should be either 11.20±0.06 VDC or 12.00±0.06 VDC. The prescribed reference voltages for the various transformer combinations are listed in the following table:

Prescribed Reference Voltages

Transformer T1	Transformer T2	Prescribed Reference Voltage
241-7-1552	241-6-1579	11.20±0.06 VDC
241-7-1552	241-6-12	12.00±0.06 VDC
241-7-1379	241-6-12	12.00±0.06 VDC

12. If the measured voltage of the unadjusted power supply is at the prescribed level, omit step 13 and proceed to step 14. If the measured voltage of the unadjusted power supply is not at the prescribed level, proceed with step 13.

13. If the measured voltage of the unadjusted power supply is not at the prescribed level, locate potentiometer P1 on the power supply circuit board (see diagram in step 6 above) and carefully adjust its set screw to provide the prescribed reference voltage. Turning the set screw clockwise increases the voltage; turning it counterclockwise decreases the voltage.

14. Once the reference voltage is properly adjusted, turn the Digistrip's power switch OFF and disconnect the power cord.

15. Disconnect the voltmeter lead wires from the power supply test points.

16. Reposition the power supply on the mounting studs and reinstall the mounting nuts.

17. Reinstall the upper paper tray and load a paper stack into the instrument.

18. Slide the chassis back into the instrument and close the front door.

19. Reconnect the power cord and resume normal instrument operation.

3.3 V1060 Power Supply Exchange

The Digistrip III Power Supply (part #V1060) is a tap-switching power source. It is designed to automatically select the proper transformer tap as the input voltage varies over its operating range. Replacement power supplies are factory-adjusted prior to shipment and normally need no further adjustment at time of installation.

Material Required

11/32" open-end wrench or small adjustable wrench
5/64" hex key

Exchange Procedure

1. With the power switch turned OFF and the power cord disconnected, open the front door of the instrument and slide the chassis forward on its rails. When sliding the chassis forward, take precautions to assure that the instrument does not tilt forward.

2. Remove the two screws holding the front edge of the upper paper tray and lift the tray out--rear edge first. The Power Supply will now be visible at the bottom rear of the chassis.

3. Disconnect the two multi-pin wire connectors from the Power Supply circuit board.

4. Remove the three nuts holding the Power Supply to the chassis base plate.

5. Grasp the Power Supply assembly by its transformers or heat sink (do not grasp the large capacitors), tilt the assembly forward and carefully lift it out of the instrument.

6. Install a replacement Power Supply (part #V1060) in the instrument by reversing the above procedures. When installing the replacement assembly, be sure to orient the wire connectors in the same manner as the old Power Supply hook-up. Also, take precautions to avoid disturbing the instrument wiring in areas surrounding the Power Supply location.

3.4 U0900 Print Control Board Exchange

The U0900 Print Control board controls outputs to the Digistrip III's internal printer. All Print Control boards are factory adjusted prior to shipment and normally need no further adjustment at the time of installation. Whenever a print control board is installed in a Digistrip III, the operation of the instrument's printer should be checked out to assure satisfactory print quality. If adjustment is needed, it may be made at that time.

Test Equipment Required

Oscilloscope
Small screw driver
¼" nut driver
Phillips screwdriver

Exchange Procedure

1. With the power switch turned OFF and the power cord disconnected, open the front door and slide the Digistrip III chassis forward on its rails. When doing this, take precautions to assure that the instrument does not tip forward.

2. Remove the black metal cover plate from the right side of the chassis by unscrewing the four cover attachment screws.

3. Remove the four stand-off studs from the Print Control Board with a ¼" nut driver.

4. Detach the two multi-pin cable connectors from the rear edge of the Print Control Board. When detaching connectors, note their orientation.

5. Detach the six-pin cable connector and ribbon cable connector from the back side of the circuit board. Note the orientation of the ribbon cable connector. The six-pin connector is non-polarized.

6. Remove the old circuit board from chassis.

7. Attach the six-pin cable connector to the back side of the replacement circuit board (part no. U0900). Because this connector is non-polarized, its orientation does not matter on replacement.

8. Attach the ribbon cable connector to the back side of the replacement circuit board. Make sure that the connector is properly oriented. Take special care to ensure that all the pins are properly mated with the ribbon connector.

9. Attach the two multi-pin cable connectors to the rear edge of the replacement circuit board. Make sure that both connectors are properly oriented.

10. Attach the replacement circuit board to the chassis with the four standoff studs.

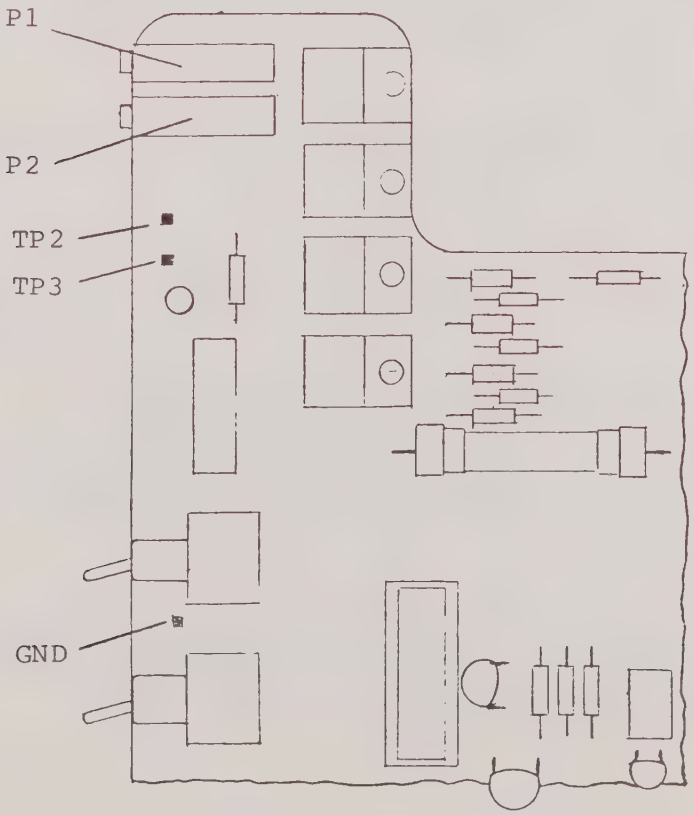
11. Re-install the cover plate with the four attaching screws.

12. Plug-in the Digistrip's power cord and turn the instrument ON. Whenever the instrument is first turned ON, it automatically prints out a new header.

13. Examine the print quality of the printed header. If adjustment is needed, it may be done according to the procedure described below.

Adjustment Procedure

1. Adjustments of the Print Control Board outputs are made by adjusting potentiometers P1 and P2 on the circuit board. On Revision E and later Print Control boards P1 and P2, as well as the test contact pins are accessible with the black metal cover plate in place (see diagram below).



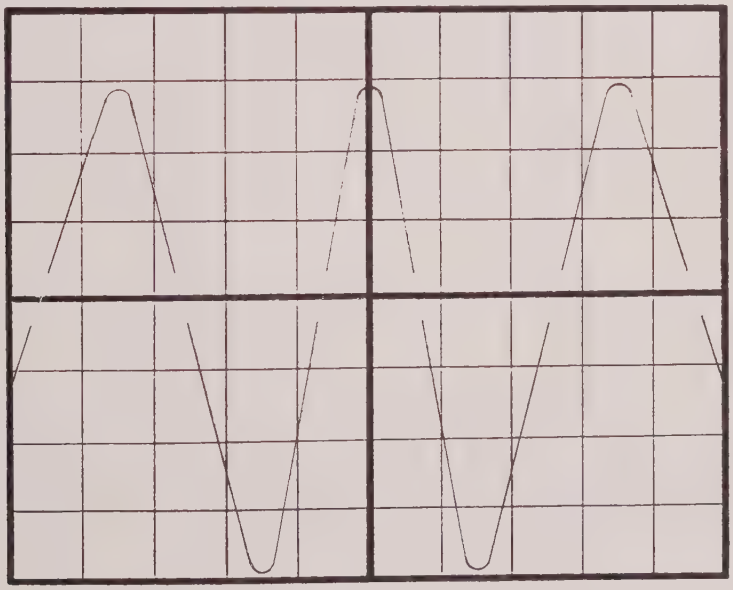
2. Program the Digistrip III for a log interval of zero and switch to the RUN mode. This will cause the instrument to print out at ten second intervals.

3. Connect the oscilloscope's ground strap to the GROUND pin on the print control board (see diagram above).

4. Touch the oscilloscope's probe to test pin 3 (TP3) or to the top of capacitor C5 on the print control board (see diagram above).

5. Turn the oscilloscope ON and set it to register 0.5V/division and 2ms/division.

6. During printouts, observe the oscilloscope screen for a timing pulse sine wave with a hysteresis point on the center horizontal line. When the timing pulse is properly adjusted, the portion of the wave above the hysteresis point will be 1.5 V, while the portion below will be 2.0 V. The diagram below shows the sine wave for a properly adjusted timing pulse.



7. Adjust the set screw on potentiometer P2 to provide the proper timing pulse as described in Step 6 above. Turning the set screw clockwise will decrease the voltage above the hysteresis point; turning it counterclockwise will increase the voltage below the hysteresis point.

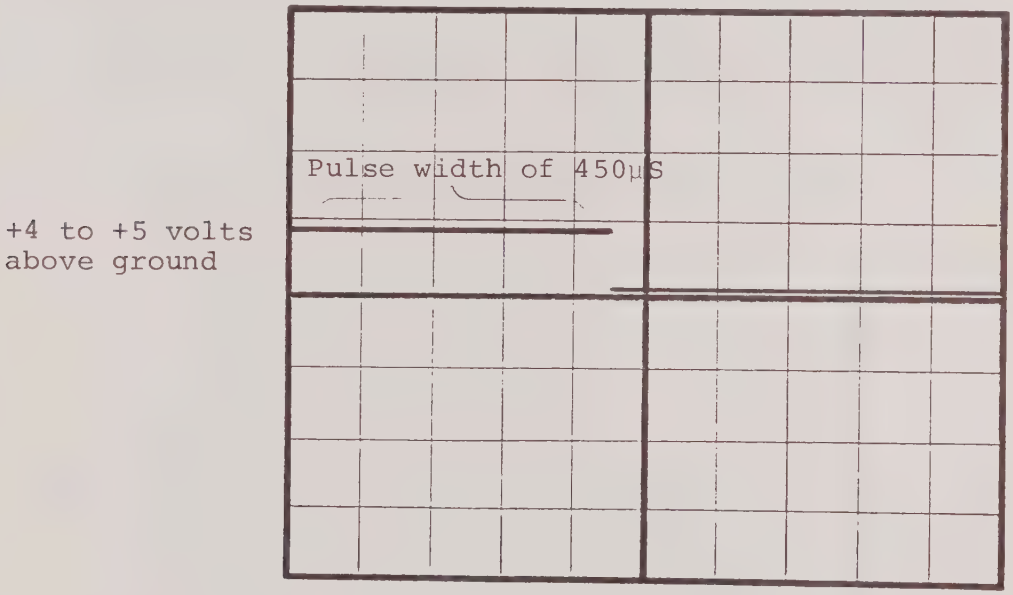
8. Potentiometer P1 is used to adjust the print hammers for a striking force which will produce an image of moderate intensity, with no character deformation.

9. Attach scope probe to test point 2.

10. The trace should be aligned to start at the left-most vertical line and adjusted to ground potential.

11. Set the SEC/DIV control to a sweep speed of 0.1 ms, and the VOLTS/DIV to 5 volts. Adjust the LEVEL control as necessary to stabilize the signal.

12. Turn P1 until a pulse width of 450 µS is achieved. Below is an example of how the scope screen should look when this calibration is correctly completed.



13. Proper positioning of the print platen also affects print quality. Adjustment of the platen is not normally required. However, if platen adjustment is needed, it is done as follows:

14. Tear off and remove the paper from the printer.

15. Position the printhead at either end of the platen and turn the Digistrip III power switch OFF. If the printhead is not at the end of the platen, briefly turn the instrument power ON; this will cause the printhead to move to one end or the other. Next, loosen the two hex key screws at the end of the platen at which the printhead is currently positioned. Using a feeler gauge, adjust the platen-to-print head clearance to 0.015 inches, then tighten the two hex screws. When tightening the hex screws, make sure that the platen is vertically positioned to provide uniform print head contact.

16. After adjusting one end of the platen, briefly turn the Digistrip III power ON; this will cause the printhead to move to the other end of the platen. With the printhead at the other end, adjust the platen-to-print head clearance at that end in the same manner as described above.

3.5 U0911 Data Acquisition Board Exchange

The U0911 data acquisition board controls the operation of all Digistrip III systems. This board contains a microprocessor and memory storage capacity, as well as all I/O signal circuitry. The data acquisition board is located on the left side of the chassis.

Material Required

- Phillips Screwdriver
- 1/4" Nut Driver

Exchange Procedure

1. With the AC power cord unplugged, open the Digistrip III's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward. With the chassis slid forward, the data acquisition board will be visible behind a black metal panel on the left side of the chassis.

2. Remove the metal panel covering the data acquisition board.

3. Disconnect the ribbon cable from the front edge of the board. When doing this, note the orientation of the cable and connector.

4. Disconnect the three cable connectors from the rear edge of the board. Again, take note of the orientation of these cables and connectors.

5. Unscrew the six stand-off studs and carefully remove the board.

6. To install the replacement board, simply reverse the procedures described above. When installing a replacement board, make sure that all cables and connectors are properly oriented.

7. Once the replacement board is installed, set the ten-position DIP switch located on the right center of the board for the same configuration as that of the original board. Alternately, the zero width adjustment procedures may be performed. For details on performing the zero width adjustment, see Section 2.3.

8. Set the Baud rate selection jumper in the same position as that of the old board. If no Baud rate jumper was present on the old board, disregard setting this jumper on the replacement board.

9. After doing the above, reconnect the AC power cord, switch the Digistrip III's power ON, then reinitialize and reprogram the instrument.

3.6 U0920 Analog Board Exchange

The Analog printed circuit board (part #U0920) constitutes the input measuring portion of the Digistrip III. It is located inside the rear door of the instrument.

Materials Required

Phillips screwdriver
¼" nut driver

Exchange Procedure

1. Turn the Digistrip III's power switch OFF and unplug the AC power cord. Next, remove the four screws securing the rear door and swing the door open. With the rear door open, the Analog board will be visible behind a black metal heat shield on the inner bulkhead.

2. Remove the heat shield to gain access to the Analog board.

3. Disconnect the two ribbon cables from the lower left corner of the board. To disconnect these cables, spread the connector extractors at both ends of the connector. When disconnecting these cables, note their orientation.

4. Disconnect the power leads (two wires) by separating the two halves of the nylon connector.

5. Unscrew the mounting nuts and stand-off studs (or screws) and carefully remove the Analog board from the instrument.

6. Before installing the replacement Analog board, look for a tag located to the right of capacitors C1 and C2 at the top edge of the circuit board. This tag will be marked with several digits separated by commas. These digits are the Analog board zero width settings. Note these digits; they will be used later in setting the slide positions on the Data Acquisition board's DIP switch.

7. Install the replacement Analog board (part #U0920) by reversing the procedures listed above. When connecting the cables to the replacement board, be sure to orient them in the same manner as the original board.

8. Reinstall the heat shield, then close and resecure the rear door.

9. Once the replacement Analog board is installed, the zero width adjustment must be set on the Data Acquisition board's DIP switch; the following steps describe this procedure.

10. Open the Digistrip III's front door and slide the chassis forward on its rails. When doing this, make sure that the instrument does not tilt forward.

11. Locate the blue DIP switch mounted in the center of the Data Acquisition board.

12. Once this DIP switch has been located, set each of the ten numbered switch slides as follows:

    - Set the slide ON if its number was listed on the tag of the Analog board.

    - Set the slide OFF if its number was <u>not</u> listed on the tag of the Analog board.

    - Slide 10 should <u>not</u> be altered.

    Setting the numbered DIP switch slides as described above adjusts the zero width to within one count; this is sufficient for almost all measurements. If finer adjustment is necessary, the zero width may be set according to the procedure described in Section 2.3 of this supplement.

3.7 U0930 Channel Access Board Exchange

Each Digistrip III contains either one, two or three channel access boards (part #U0930). These boards receive analog inputs via their isothermal terminal blocks and multiplex these inputs to the digital voltmeter. All U0930 channel access boards are factory adjusted prior to shipment and normally need no further calibration at the time of installation. When used with thermocouple inputs, however, the internal reference RTD should be recalibrated from time to time. Section 2.4 of this Supplement provides a detailed description of the RTD calibration procedure.

The channel access boards are mounted either (A) on the standard rear door panel, or (B) in a high accuracy thermocouple input panel attached to the rear door. The following procedures describe the techniques used to isolate and exchange a defective channel access board.

Materials Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Defective Board Isolation Procedure

1. With the Digistrip's power cord connected to a line voltage outlet, the power switch turned ON and the PROGRAM/RUN switch set in the PROGRAM position, initiate a printout of complete program information by pressing the LIST PROGRAM key.

2. Once the program printout is completed, review it carefully to make sure that all programmed instructions are accurate and complete. If program changes are required, they should be made at this time.

3. From the table below, select the symptom which represents the system problem being experienced. Having selected the problem symptom, proceed to the steps indicated.

Problem Symptom	Proceed to Steps
All channel data readings are improper	4 - 10
All channel data readings for a particular terminal bank are improper.	11

Problem Symptom	Proceed to Steps
All thermocouple readings for a particular terminal bank are improper.	12 - 17
Individual channel data values are improper.	18

4. Place the PROGRAM/RUN switch in the PROGRAM position and assign Function 01 (the 65 mv DVM measuring scale) to the first channel of the channel line assigned to each terminal bank. For example, in a system containing two terminal banks, if Channel Line 100 is assigned to Terminal Bank 1, and Channel Line 200 is assigned to Terminal Bank 2, Function 01 would be assigned to Channels 101 and 201.

5. After completing step #4 above, reset the PROGRAM/RUN switch in the RUN position and turn the power switch OFF.

6. Open the Digistrip's rear door and remove the black metal plate covering the analog board.

7. Locate the small neon bulb mounted in the lower left corner of the analog board. Short out this bulb by connecting a jumper across its two lead wires.

8. Disconnect the small ribbon cable at the lower left corner of the analog board.

9. Turn the power switch back ON and examine the displayed value of the first channel in the channel group assigned to each terminal bank.

10. If the first channel assigned to each terminal bank reads approximately 00.000 mv, the first channel access board (terminal bank 1) probably is defective and in need of replacement. If the first channel assigned to each terminal bank reads other than approximately 00.000, the analog board probably is defective and in need of replacement.

11. If all data readings for a particular channel access board are improper, that channel access board probably is defective and in need of replacement.

12. If all thermocouple readings for one or more channel access boards are improper, but other input types read properly, proceed to step #13.

13. With the PROGRAM/RUN switch set in the RUN position, call up the displayed value of the data in channel 906. Channel 906 provides the voltage measurement across the internal temperature measuring RTD of the first channel access board (Terminal Bank 1). Under normal ambient temperature conditions--15° to 32°C (60° to 90°F), the displayed value of channel 906 should be in the 31 to 35 mv range. Any reading outside of this range is indicative of a component failure.

14. If the Digistrip has a second channel access board (Terminal Bank 2), call up the displayed value of the data in channel 907. Channel 907 provides the voltage measurement across the internal temperature measuring RTD of Terminal Bank 2. As with channel 906, under normal ambient temperature conditions, this voltage measurement should be in the 31 to 35 mv range.

15. If the Digistrip has a third channel access board (Terminal Bank 3), call up the displayed value of the data in channel 908. Channel 908 provides the voltage measurement across the internal temperature measuring RTD of Terminal Bank 3. As with channels 906 and 907, under normal ambient temperature conditions, this voltage measurement also should be in the 31 to 35 mv range.

16. If one or more of the internal RTD readings are outside of the 31 to 35 mv range, the channel access board associated with that RTD probably is defective and in need of replacement.

17. If all internal RTD readings are within the 31 to 35 mv range, but thermocouple readings are still improper, contact your nearest Kaye Instruments customer service office.

18. If individual channel data inputs read improperly, proceed with step #19.

19. If several inputs which are assigned the same DVM analog range read improperly, reprogram those inputs for a different voltage range. If the inputs read correctly after changing the range the analog board probably is defective and should be exchanged. If reassigning the input range does not correct the readings, restore the original function assignment and proceed with step #20.

20. Move each input which reads improperly to an unused input address and assign the proper function number. If the relocated input reads properly, the channel access board has a defective input relay. The channel access board should be exchanged. If the improper reading follows the input wiring, the sensor itself probably is defective and should be repaired.

Exchange Procedure (for standard rear door panels)

1. With the instrument's power switch turned OFF and the power cord disconnected, remove the input terminal cover from the rear of the instrument and disconnect all input leads from the board to be exchanged.

2. Remove the four mounting screws from the board to be exchanged.

3. Remove the four securing screws from the rear door and swing the door open. With the rear door open, the channel access board(s) will be visible on the inside of the door.

4. Disconnect the ribbon cable connector from the left side of the board to be exchanged.

5. Remove the nut from the mounting stud at the left side of the board, lift the board off the stud and slide it to the right and off the door.

   Note: When removing an old channel access board, observe the position of the Group Select jumper and set the new board's jumper in the same position.

6. Install the replacement board by reversing the procedures described above.

   Note: When installing a channel access board as a system expansion, the new board must be installed in place of a blank cover plate on the instrument's rear door. Whenever an expansion board is installed, it must be connected to the ribbon cable. Also, it must have its Group Select jumper set for the new group of channels. When setting this jumper, make sure that its setting does not duplicate that of any other channel access board in the system.

Exchange Procedure (for high accuracy thermocouple input panels)

1. With the instrument's power switch turned OFF and the power cord disconnected, remove the input terminal cover from the high accuracy panel and disconnect all input leads from the board to be exchanged.

2. Remove the two mounting screws from the left side of the terminal block of each board.

3. Remove the two mounting screws from the right side of the terminal block of the board to be exchanged.

4. Remove the two rear door securing screws from the left end of the high accuracy panel and swing the door open.

5. With the panel door open, slide the mounting plate off the end of the door and disconnect the ribbon cable connector from the left side of the board to be exchanged.

6. Remove the nut from the mounting stud at the left side of the board to be exchanged. Lift the board off the stud and slide it to the right and off the door.

   Note: When removing an old channel access board, observe the position of the Group Select jumper and set the new board's jumper in the same position.

7. Install the replacement board by reversing the procedures described above.

   Note: When installing a channel access board as a system expansion, the new board must be installed in place of a blank cover plate on the high accuracy panel. Whenever an expansion board is installed, it must be connected to the ribbon cable. It also must have its Group Select jumper set for the new group of channels. When setting this jumper, make sure that its setting does not duplicate that of any other channel access board in the system.

3.8 V1030 Carriage Motor Exchange

When printing out information, the printhead of the Digistrip III moves back and forth across the page. It is mounted on two slide bars and driven by a chain assembly powered by a carriage motor (part #V1030). The carriage motor is located beneath the upper paper tray near the right side of the chassis.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- 11/32" Nut Driver
- Allen Wrench Set
- Molex Pin Extractor

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Sections 3.5 and 3.4

5. Locate the carriage motor which is mounted near the right side of the chassis interior.

   Note: When exchanging the carriage motor, take precautions to avoid touching, soiling, or damaging the delicate optical timing fence located in the printhead area.

6. Disconnect the carriage motor power cable. The connector on this cable is located in the lower rear right corner of the chassis.

7. Using the Molex pin extractor, disassemble the connector on the carriage motor power cable.

8. Loosen the carriage motor mounting screws, remove the drive chain from the drive gear, and lift the carriage motor out of the chassis (see Section 3.12 for details).

9. Install a new carriage motor (part #V1030) by reversing the procedures described above.

10. Once the replacement carriage motor is properly installed, close up the instrument and resume normal monitoring operations.

3.9 M3130 Timing Fence Exchange

The character printout timing of the Digistrip's printhead is controlled by the optical timing fence (part #M3130). The timing fence is a transparent plastic strip marked with opaque vertical lines. It is mounted in the front interior area of the chassis. As the printhead moves back and forth across the page, its photo detector scans the timing fence and transmits a sequence of timing signals to the print control board. These signals in turn control the character printout timing.

Note: Because of the critical nature of its optical properties, the timing fence must be kept clean and free from damage. When handling a timing fence, avoid touching, soiling, or damaging its critical areas.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Sections 3.5 and 3.4.

5. Standing in front of the instrument, examine the chassis interior and locate the timing fence. Note that it is oriented with the line pattern side down and the clear area on the left.

6. Loosen the screws used to attach the timing fence mounting brackets to both chassis side panels.

7. Remove the old timing fence from the instrument.

8. Remove the mounting brackets from the old timing fence and mount them on the new one.

9. Install the replacement timing fence in the instrument by reversing the procedures described above. When doing this, make sure that the new fence is oriented in the same manner as the old one (see step #5 above).

10. Adjust the alignment and tension of the timing fence by proper positioning of its mounting brackets. When the timing fence is properly installed, the printhead's photo detector should move along the fence without touching it.

11. Once the replacement timing fence is properly installed, close up the instrument and resume normal monitoring operations.

3.10 V1010 Printhead Exchange

The Digistrip printhead (part #V1010) is an electro-mechanical impact printing device. The printing mechanism consists of seven vertically aligned print hammers. As the printhead moves back and forth across the page, the print hammers strike the pressure-sensitive paper, thereby creating the printed characters.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set

Exchange Procedure

1. With the power cord connected to a line voltage outlet, the power switch turned OFF and the PROGRAM/RUN switch set in the RUN position, remove the paper from the Digistrip's printer.

2. Turn the power switch ON. When the power switch is turned ON, the printhead will move across the paper area in one direction and stop. Turn the power switch OFF. The next time the power switch is turned ON, the printhead will move in the other direction and stop. With the paper removed from the printer, the front end of the printhead will be visible beneath the black metal paper guide.

3. Starting with the power switch turned OFF and the printhead at the right side of the paper area, turn the power switch ON. When the printhead reaches the middle of the paper area, stop its movement by turning the power switch OFF.

4. Disconnect the power cord and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

5. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

6. Remove the print control board (right side of chassis). For instructions on the removal of this board, see Section 3.4.

7. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

Note: For some early production Digistrip III units, it is necessary to remove both the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of the data acquisition board, see Section 3.5.

8. Locate the printhead. Note that it is mounted on two horizontal slide bars.

   Note: When conducting the printhead exchange procedure, take precautions to prevent touching, soiling, or damaging the delicate optical timing fence located in the printhead area.

9. Disconnect the drive chain from the printhead by carefully lifting the upper chain span and removing the drive pin from its vertical track. Once the pin has been removed from its track, the tension on the chain should hold the pin in place in the chain end links.

   Note: As an alternative procedure for disconnecting the drive chain from the printhead, the chain may be carefully pulled forward off the drive pin.

10. Once the drive chain is disconnected from the printhead, use a small screwdriver to remove the "C" clips from both ends of the printhead's rear slide bar.

11. Carefully pull the rear slide bar out of the chassis through the right side panel. When the rear slide bar is removed, the printhead will be left resting on the front slide bar.

12. Unplug the printhead ribbon cable from the cable connector mounted on the chassis' right side panel. When doing this, take note of the orientation of the cable.

13. Carefully lift the printhead off the front slide bar and out of the instrument. When doing this, avoid touching or damaging the optical timing fence.

14. Install the replacement printhead in the instrument by reversing the procedures described above. When hooking up the ribbon cable connector, make sure that the cable is installed without twists and that the connector pins are properly aligned. Improper connection of the ribbon cable may result in permanent damage to the printhead.

15. Once the replacement printhead has been installed, close up the instrument and resume normal monitoring operations.

3.11 W1560 Paper Take-Up Motor Exchange

Paper is fed through the Digistrip's printer by the tractor drive mechanism. This mechanism is powered by the paper take-up motor (part #W1560). The paper take-up motor is mounted on the right side panel of the chassis.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this take precautions to prevent the instrument from tipping forward.

2. Remove the print control board (right side of chassis). For details on the removal of this board, see Section 3.4.

3. Locate the paper take-up motor.

4. Loosen the set screw on the motor pulley and remove the pulley and drive belt.

5. Loosen the motor mounting screws and remove the paper take-up motor from the side panel.

6. Install a replacement motor by reversing the procedure described above. When mounting the replacement motor, make sure that a small amount of play is left in the drive belt. When reconnecting the cables to the print control board, note that the ribbon cable must be properly oriented, while the orientation of the six-pin connector makes no difference.

7. Once the replacement motor has been installed, close up the instrument, reconnect the power cord to a line voltage outlet, turn the power switch ON, and resume normal monitoring operations.

3.12 Printhead Drive Assembly -- Checkout, Adjustment and Lubrication

The printhead drive assembly consists of the printhead, two slide bars, the carriage motor, the drive chain, the drive chain connection pin, and two drive gears. In order for the printer to operate normally, all of these components must be in good condition and properly installed and adjusted. In addition, the printhead slide bars must be kept clean, smooth and adequately lubricated. The following checkout, adjustment and lubrication procedure should be carried out whenever the printhead moves erratically, or squeaks during operation.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set
- Tri-Flon Lubricant (or thin lubricating oil)

Checkout, Adjustment and Lubrication Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis -- rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Section 3.5 and 3.4.

5. Examine the inside of the chassis and locate the following components:

   - Printhead
   - Slide Bars (2)
   - Carriage Motor
   - Drive Chain
   - Drive Chain Connection Pin
   - Drive Gears (2)

   Note: When working on the drive chain assembly, take precautions to avoid touching, soiling, or damaging the delicate optical timing fence located in the printhead area.

6. Check out the printhead to make sure that its path of movement is unobstructed. If an obstruction exists, remove it.

7. Check out the two printhead slide bars to make sure that they are straight, smooth, clean, and lightly lubricated. If a slide bar is bent, it should be replaced. If a bar is rough, remove it from the instrument and polish it with crocus cloth or fine steel wool. If a bar needs cleaning, wipe it down with alcohol. To lubricate the slide bars, apply a thin, uniform coat of Tri-Flon lubricant (or thin lubricating oil).

   Note: For instructions on how to remove the slide bars, see Section 3.10.

8. Check out the carriage motor to make sure that it is properly mounted (see Section 3.8).

9. Check out the drive chain to make sure that it is properly mounted and stretched tight. If there is slack in the chain, tighten it by adjusting the position of the carriage motor on its mounting bracket.

10. Check out the drive chain connection pin to make sure that it is capable of moving up and down freely in its mounting track.

11. Check out the two drive gears to make sure that they are properly mounted and aligned.

12. After carrying outs steps 1-11 above, reassemble the Digistrip, reconnect the power cord and check out the instrument for proper printhead operation. If the printhead still moves erratically, either the print control board or the carriage motor probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4. For the carriage motor exchange procedure, see Section 3.8.

13. Once the printhead malfunction has been corrected, close up the instrument and resume normal monitoring operations.

3.13 U0950 Digital Display Board Exchange

The digital display printed circuit board is mounted on the inside of the Digistrip's front door. It contains an array of LED display elements and indicator lamps. Whenever the instrument is operating, selected LEDs and indicator lamps are visible through windows in the control panel.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Double Sided Mounting Tape

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis) and locate the ribbon cable connector mounted in the upper right corner of the data acquisition board.

3. Unplug the ribbon cable connector from the data acquisition board.

4. Carefully observe how the ribbon cables are mounted on the inside of the front door and fed into the left side of the chassis. Note that double sided mounting tape is used in several areas to hold the cables in place.

5. Unplug the ribbon cable connector from the keyboard printed circuit board. This board is mounted near the lower left corner of the front door interior.

6. Unscrew the four mounting screws from the digital display board and carefully remove the board and ribbon cable assembly from the instrument.

7. Install the replacement digital display board by reversing the steps described above. When installing a replacement board, make sure that the ribbon cables are properly positioned and held in place with double sided mounting tape.

8. Once the replacement digital display board is installed, close up the instrument, connect the power cord to a line voltage outlet, turn the power switch ON, and resume normal monitoring operations.

3.14 M3100 Control Panel Exchange

The Digistrip III control panel (part #M3100) is a touch-sensitive membrane keyboard mounted on the front door of the instrument. All operating and programming instructions are entered via the control panel.

Equipment Required

- Small Regular Screwdriver

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and locate the control panel ribbon cable connector mounted in the upper left corner of the door interior.

2. Unplug the ribbon cable connector.

3. Using a small screwdriver, carefully pry loose the left edge of the control panel, then peel the panel off the door and discard it. Clean off any adhesive remaining on the door.

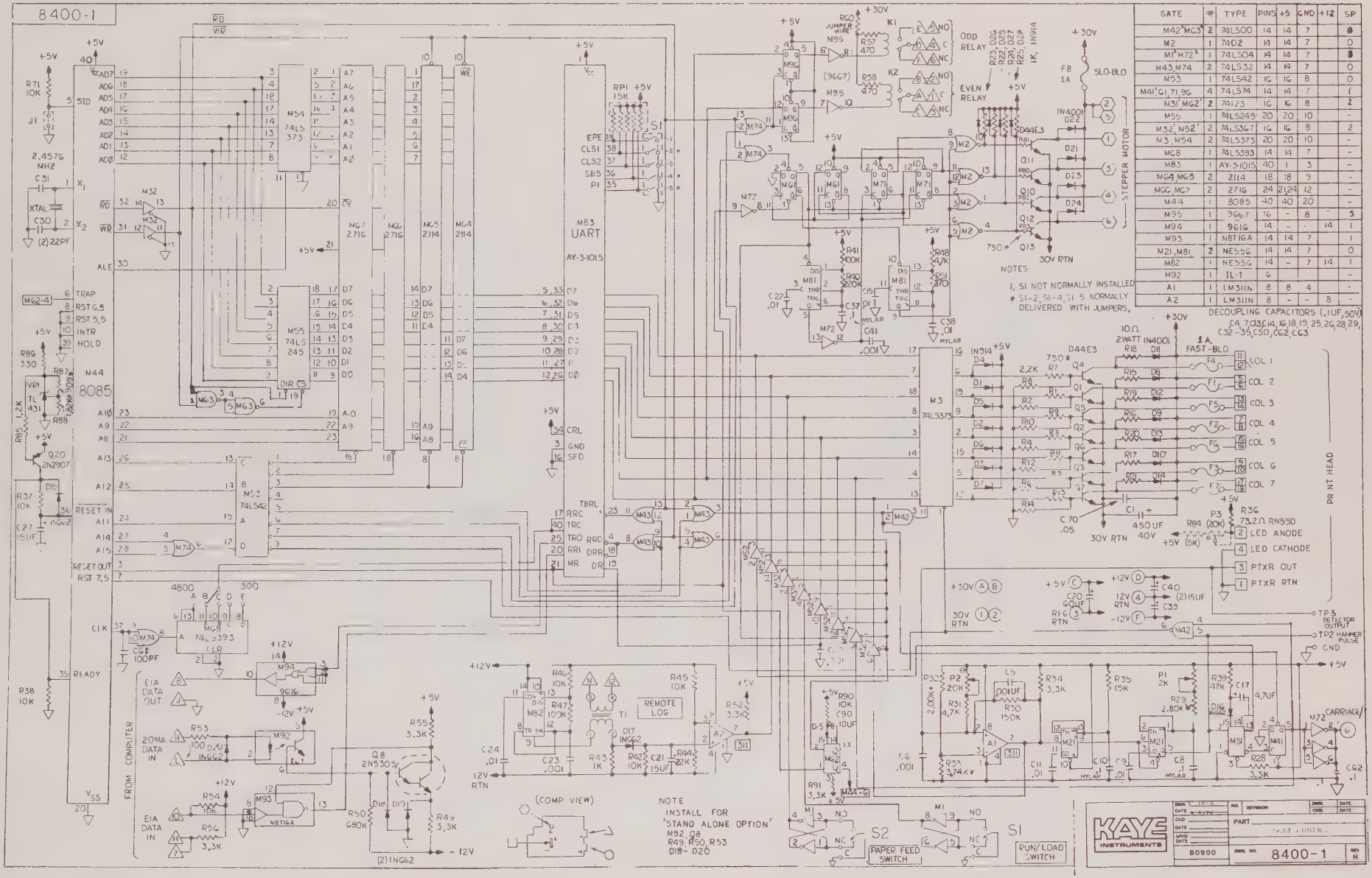
4. Peel the protective backing off the replacement display panel, feed its ribbon cable through the slot near the right edge of the front door and carefully position the panel on the door.

5. After the panel is properly positioned, attach it to the door with firm hand pressure and plug in the ribbon cable connector.

6. Once the replacement control panel has been installed, close up the instrument, connect the power cord to a line voltage outlet, turn the power switch ON and resume normal monitoring operations.

SECTION 4 - SCHEMATICS

Circuit Board	Drawing Number	Bare Board Number	Finished Board Number	Assembly Number
Print Control	8400-1	B0900	U0900	--
Data Acquisition	8400-11 (Sh. 1 of 4)	B0911	U0911	--
Data Acquisition	8400-11 (Sh. 2 of 4)	B0911	U0911	--
Data Acquisition	8400-11 (Sh. 3 of 4)	B0911	U0911	--
Data Acquisition	8400-11 (Sh. 4 of 4)	B0911	U0911	--
Analog	8400-3	B0920	U0920	--
Channel Access	8400-4	B0930	U0930	--
Display	8400-6	B0950	U0950	--
Power Supply	8400-7	B0960	U0960	V1060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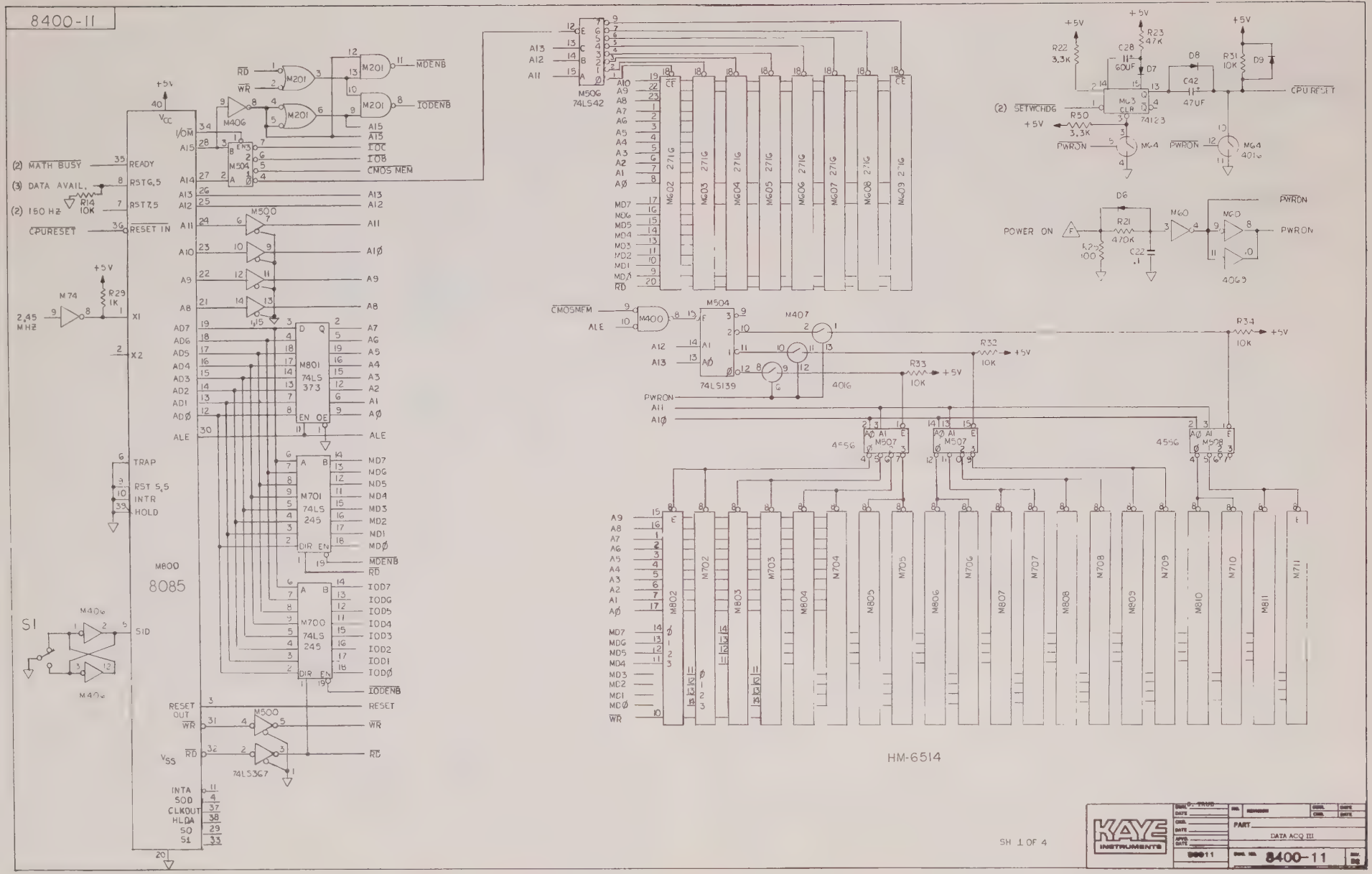
M2
M1,M72
M43,M74
M53
M41,G1,71,96
N31,M62
M55
M32,N52
N3,M54
M68
M83
M64,M65
M66,M67
M44
M95
M93
M94
M21,M81
M82
M92
A1
A2
GATE
#
TYPE
PINS
+5
GND
+12
SP
74LS00
74D2
74LS04
74LS32
74LS42
74LS74
74123
74LS245
74LS367
74LS373
74LS393
AY-3-1015
2114
2716
8085
9616
N8T16A
NE555
IL-1
LM311N
LM311
8
0
1
2
3
4
5
6
7
8
9
10
M54
74LS 373
M55
74LS 245
M57
2716
M56
2716
M63
2114
M64
2114
M83
UART
AY-3-1015
M44
8085
M52
74LS42
M53
74LS393
M3
74LS373
M31
M41
M21
M72
CARRIAGE
M92
M93
M94
M95
M74
M72
M42
M43
M52
M53
M63
M64
M65
M66
M67
M68
M71
M81
M82
M91
M92
M93
M94
M95
M2
M3
M31
M41
M42
M43
M52
M53
M63
M64
M65
M66
M67
M68
M71
M72
M74
M81
M82
M91
M92
M93
M94
M95
RD
WR
ALE
TRAP
RST 6.5
RST 5.5
INTR
HOLD
RESET IN
RESET OUT
RST 7.5
CLK
READY
SID
SOD
HLDA
INTA
IO/M
S1
S0
CLK OUT
AD7
AD6
AD5
AD4
AD3
AD2
AD1
AD0
A15
A14
A13
A12
A11
A10
A9
A8
D7
D6
D5
D4
D3
D2
D1
D0
EPE
CLS1
CLS2
SBS
PI
CRL
GND
SFD
TBRL
RRC
TRC
TRO
RRI
MR
RRD
DRR
DR
TRL
TRR
2.4576 MHZ
XTAL
(2)22PF
RPI +5V 15K
DIR CS
RS232 IN
RS232 OUT
EIA DATA OUT
20MA DATA IN
EIA DATA IN
FROM COMPUTER
TO COMPUTER
REMOTE LOG
(COMP VIEW)
PAPER FEED SWITCH
RUN/LOAD SWITCH
ODD RELAY
EVEN RELAY
SLO-BLO
STEPPER MOTOR
PRINT HEAD
COL 1
COL 2
COL 3
COL 4
COL 5
COL 6
COL 7
LED ANODE
LED CATHODE
PTXR OUT
PTXR RTN
DETECTOR OUTPUT
HAMMER PULSE
GND
+5V
+12V
-12V
+30V
30V RTN
12V RTN
5V RTN
NOTES
1. S1 NOT NORMALLY INSTALLED
S1-2, S1-4, S1-5 NORMALLY DELIVERED WITH JUMPERS.
DECOUPLING CAPACITORS (.1UF,50V)
C4, 7, C13, 14, 16, 18, 19, 25, 26, 28, 29, C32-35, C50, C62, C63
NOTE
INSTALL FOR 'STAND ALONE OPTION'
M92, Q8
R49, R50, R53
D18-D20
KAYE INSTRUMENTS
PRINT CONTROL
8400-1
B0900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M800
M801
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M802
M803
M804
M805
M806
M807
M808
M809
M810
M811
M400
M401
M402
M403
M404
M405
M406
M407
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M508
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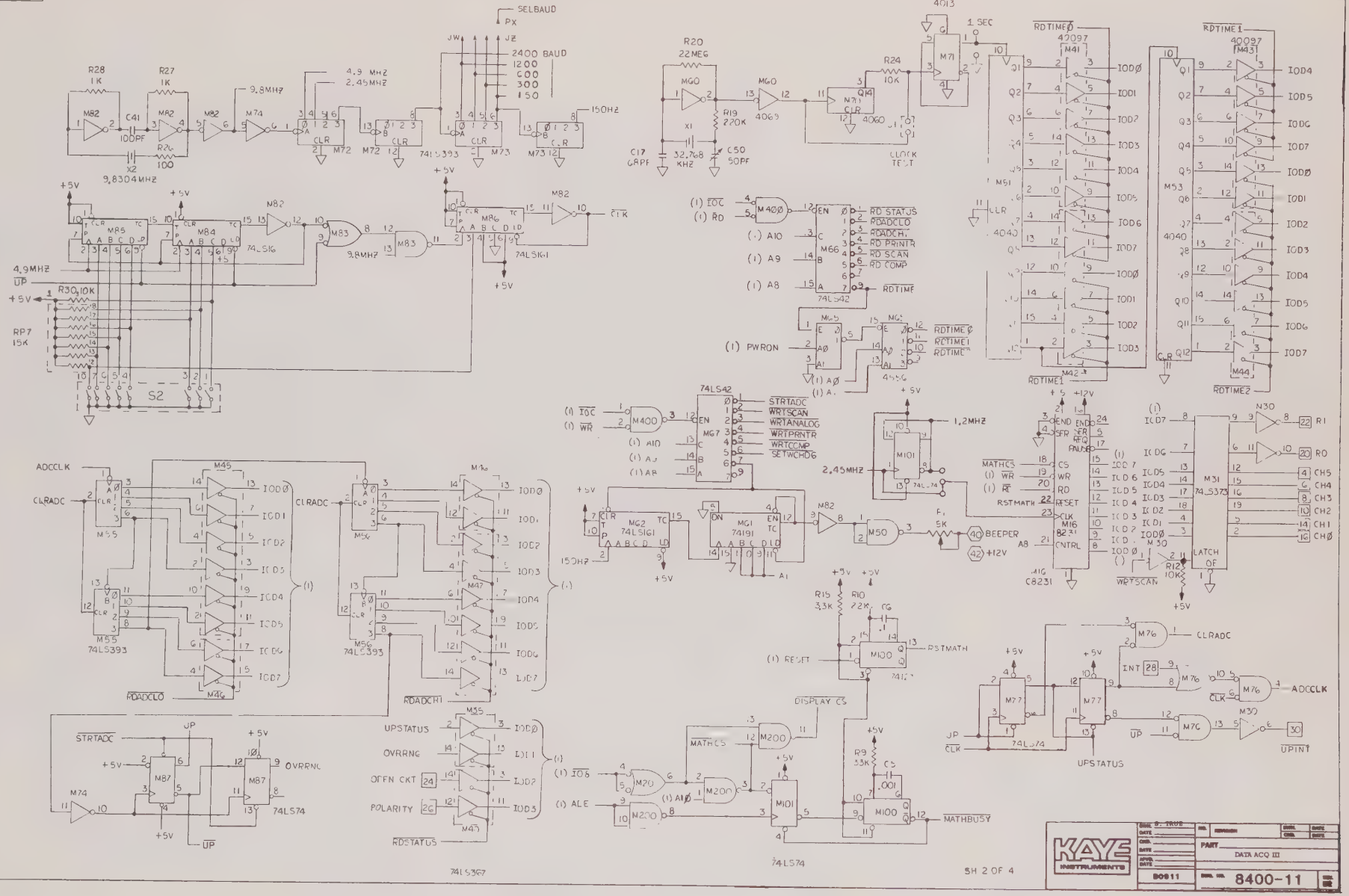
M60
M61
M62
M63
M64
M74
M201
M504
74LS373
74LS245
74LS139
74LS42
74LS367
74123
4066
4011G
4556
271G
2716
MATH BUSY
DATA AVAIL.
150 HZ
CPURESET
2.45 MHZ
SID
HM-6514
SH 1 OF 4
KAYE INSTRUMENTS
DATA ACQ III
8400-11



SH 2 OF 4

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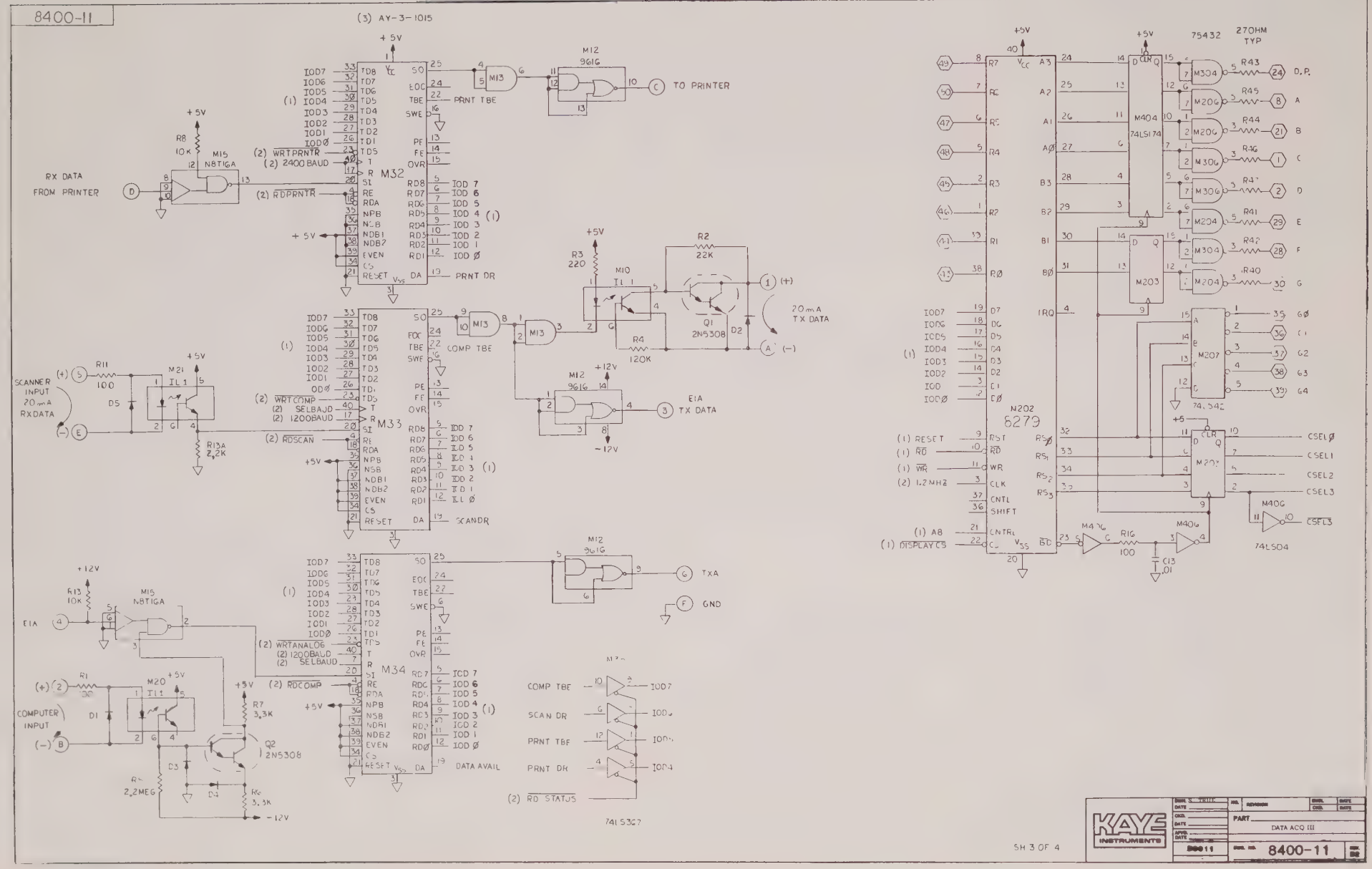
	DATE	PART	DATA ACQ III
	APVD		
	DATE		
	BOB11	DWG NO.	8400-11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+5V
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IOD6
IOD5
IOD4
IOD3
IOD2
IOD1
IODØ
TD8
TD7
TD6
TD5
TD4
TD3
TD2
TD1
TDS
SO
EOC
TBE
SWE
PE
FE
OVR
M32
M33
M34
M12
9616
M13
PRNT TBE
TO PRINTER
(2) WRTPRNTR
(2) 2400 BAUD
(2) RDPRNTR
PRNT DR
COMP TBE
(2) WRTCOMP
(2) SELBAUD
(2) 1200BAUD
(2) RDSCAN
SCANDR
(2) WRTANALOG
(2) RDCOMP
DATA AVAIL
RX DATA
FROM PRINTER
R8
10K
M15
N8TIGA
SCANNER
INPUT
20 mA
RXDATA
R11
100
D5
M21
R13A
2.2K
EIA
R13
10K
M18
R1
30
M20
D1
COMPUTER
INPUT
R7
3.3K
Q2
2N5308
D3
D4
R6
3.3K
-12V
R3
220
M10
R2
22K
Q1
2N5308
D2
R4
120K
20 mA
TX DATA
EIA
TX DATA
TXA
GND
COMP TBE
SCAN DR
PRNT TBE
PRNT DR
(2) RD STATUS
74LS367
+5V
75432
270HM
TYP
M404
74LS174
M203
M204
M205
M206
M207
M304
M306
R43
R45
R44
R46
R47
R41
R42
R40
D.P.
A
B
C
D
E
F
G
N202
8279
74LS42
74LS04
RESET
RD
WR
1.2 MHz
CNTL
SHIFT
CNTRL
A8
DISPLAYCS
CSELØ
CSEL1
CSEL2
CSEL3
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C13
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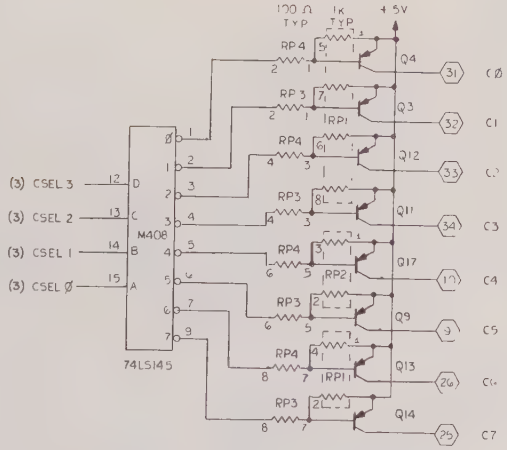
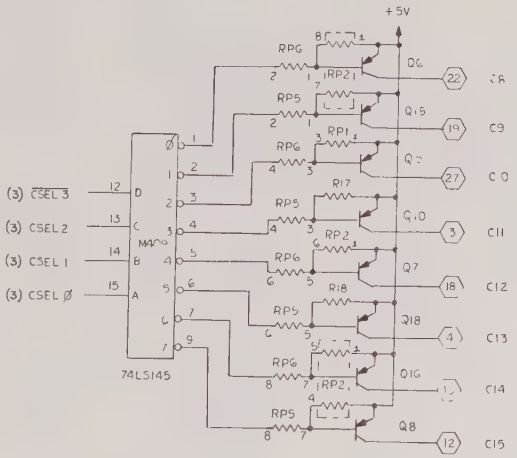
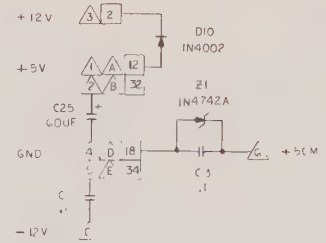
PART
DATA ACQ III
8400-11
SH 3 OF 4

8400-11







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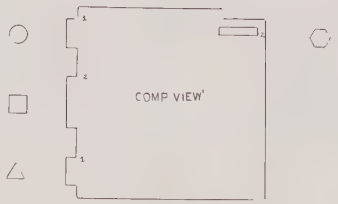
M702–711 M802–811	20	6514	18	18	9				-
M800	1	8085	40	40	20				-
M202	1	8279	40	40	20				-
M12	1	9616	14		7		14	8	-
M32, M33, M34	3	AY-3-1015	40	1	3				-
M16	1	C8231	24						-
M15	1	N8T16A	14	14	7				0
M10, M20, M21	3	TL-1	6	-	-	-			-
M71	1	4013	14		7	14			1
M64, M407	2	4016	14		7	14			3
M51, M53	2	4040	16		8	16			-
M70	1	4060	16		8	16			-
M60	1	4069	14		7	14			1
M65, M507, M508	3	4556	16		8	16			1
M41 – M44	4	40097	16		8	16			0
M83, M200, M201	3	74LS00	14	14	7				2
M76	1	74LS02	14	14	7				0
M74, M82, M406	3	74LS04	14	14	7				3
M30	1	7405	14	14	7				2
M13	1	7408	14	14	7				1
M400	1	74LS32	14	14	7				1
M66, 67, 207, 506	4	74LS42	16	16	8				-
M77, M87, M101	3	74LS74	14	14	7				-
M63, M100	2	74123	16	16	8				1
M504	1	74LS139	16	16	8				0
M408, M409	2	74LS145	16	16	8				-
M62, 84, 85, 86	4	74LS161	16	16	8				-
M203, M404	2	74LS174	16	16	8				0
M61	1	74191	16	16	8				-
M700, M701	2	74LS245	20	20	10				-
M35, 40, 45, 46, 47, 300	6	74LS367	16	16	8				6
M31, M801	2	74LS373	20	20	10				0
M55, 56, 72, 73	4	74LS393	14	14	7				-
M50, 204, 206, 304, 306	5	75432	8	8	4				-

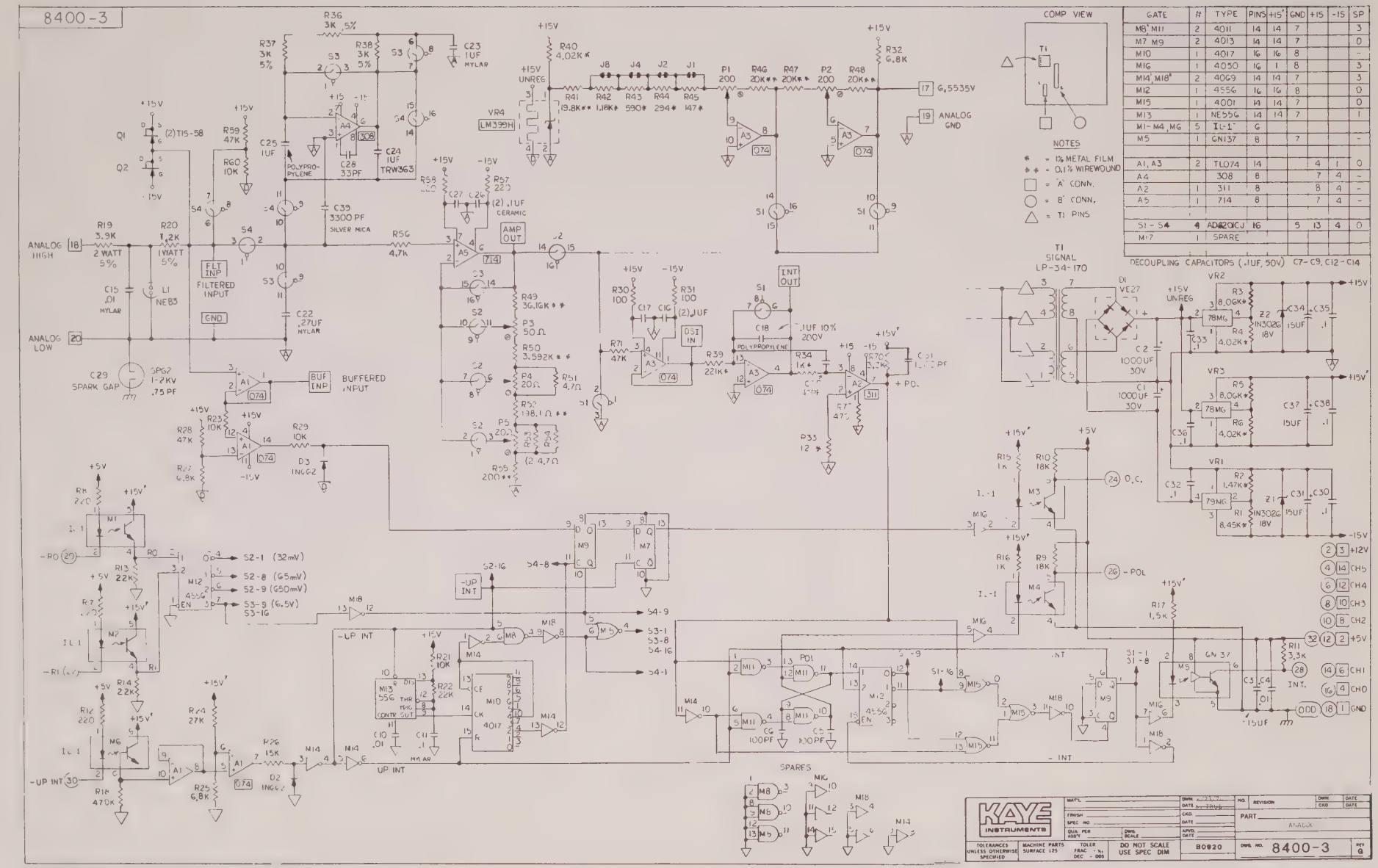


SH 4 OF 4

KAYE INSTRUMENTS

PART DATA ACQ III

8400-11



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M7 M9	2	4013	14	14	7			0
M10	1	4017	16	16	8			-
M16	1	4050	16	1	8			3
M14, M18	2	4069	14	14	7			3
M12	1	4556	16	16	8			0
M15	1	4001	14	14	7			0
M13	1	NE556	14	14	7			1
M1-M4, M6	5	IL-1	6					
M5	1	GN137	8		7			-
A1, A3	2	TL074	14			4	1	0
A4		308	8			7	4	-
A2	1	311	8			8	4	-
A5	1	714	8			7	4	-
S1 - S4	4	AD8201CJ	16			5	13	4	0
M17	1	SPARE						

8400-4

GATE	#	TYPE	PINS	+5	GND	SP
M2, M3	2	74141	16	5	12	—
M1	1	74S287	16	16	8	—
RELAYS	18	3402-12-8	COTO-COIL			

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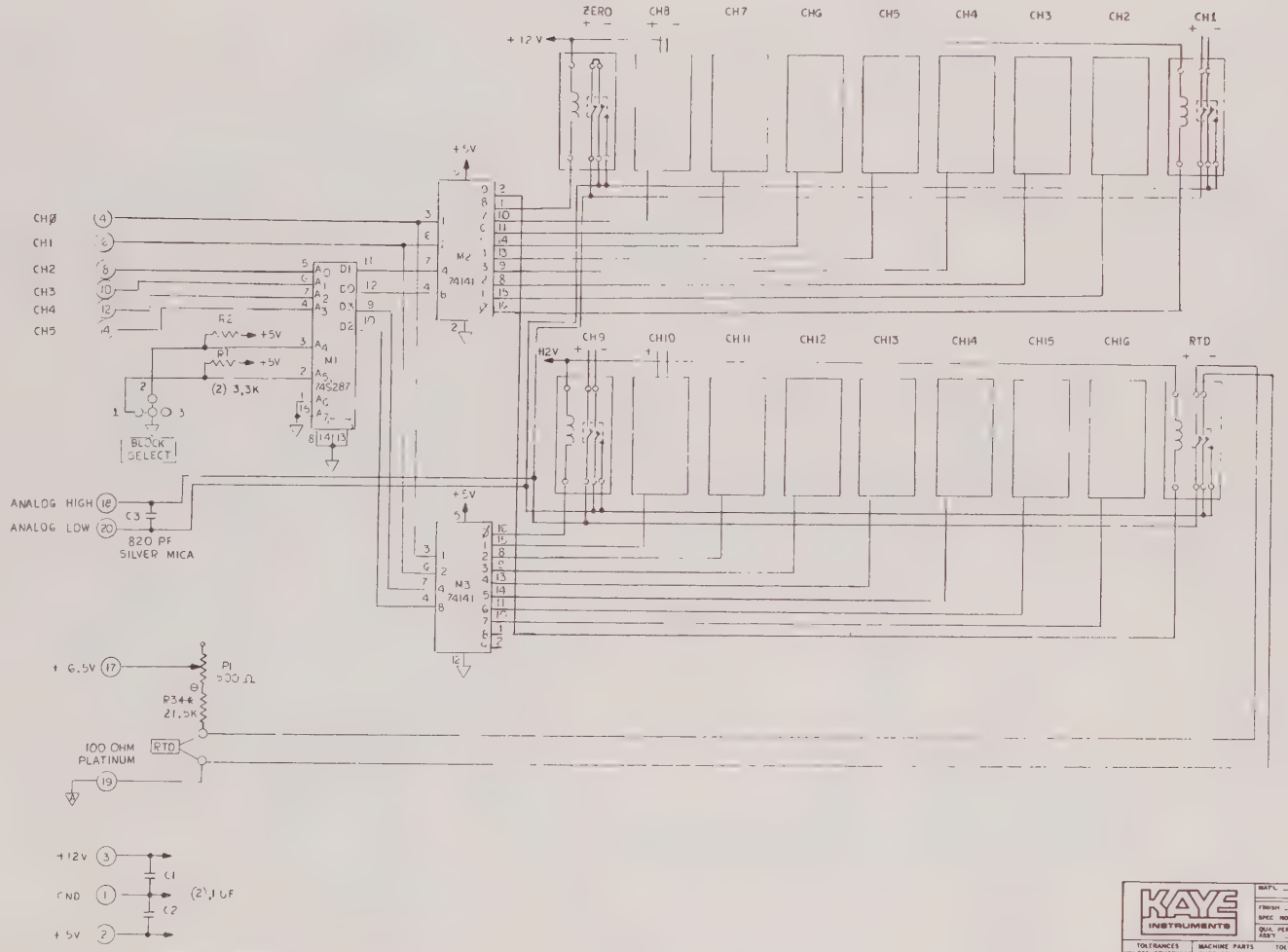

KAYE INSTRUMENTS

S. TRUE 8/11/72

MAT'L	DWN DATE	NO.	REVISION
FINISH	CAD DATE	PART	CHANNEL ACCESS
SPEC NO	APVD DATE		
QUA. PER ASS'Y	DWG SCALE		
TOLERANCES UNLESS OTHERWISE SPECIFIED	MACHINE PARTS SURFACE 125	TOLER FRAC ± ½ DEC ± .005	DO NOT SCALE USE SPEC DIM

B0930

DWG NO 8400-4 REV E1

8400-6

GATE	#	TYPE	PINS			SP
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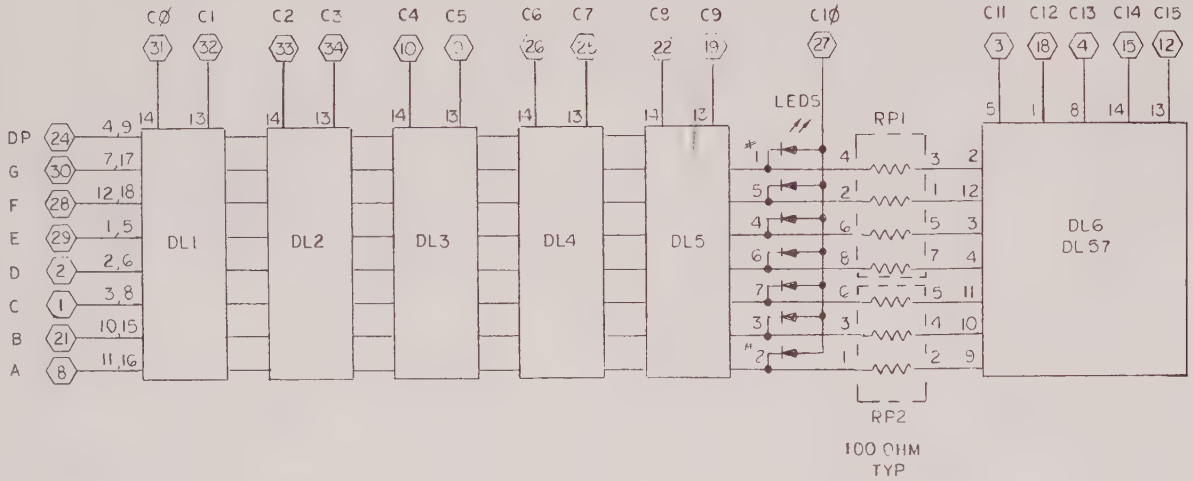
DL1-DL5	5	DL727	18			-



S. TRUE

KAYE INSTRUMENTS

MAT'L.
FINISH
SPEC. NO.
QUA. PER ASS'Y.
DWG. SCALE
DWN. DATE 12/4/78
CK'D. DATE
APV'D. DATE
80950

NO. REVISION DWN. DATE CK'D. DATE

PART DIC. DISPLAY

TOLERANCES UNLESS OTHERWISE SPECIFIED
MACHINE PARTS SURFACE 125— TOLER. FRAC. ±1/32 DEC. ±.005
DO NOT SCALE USE SPEC. DIM.

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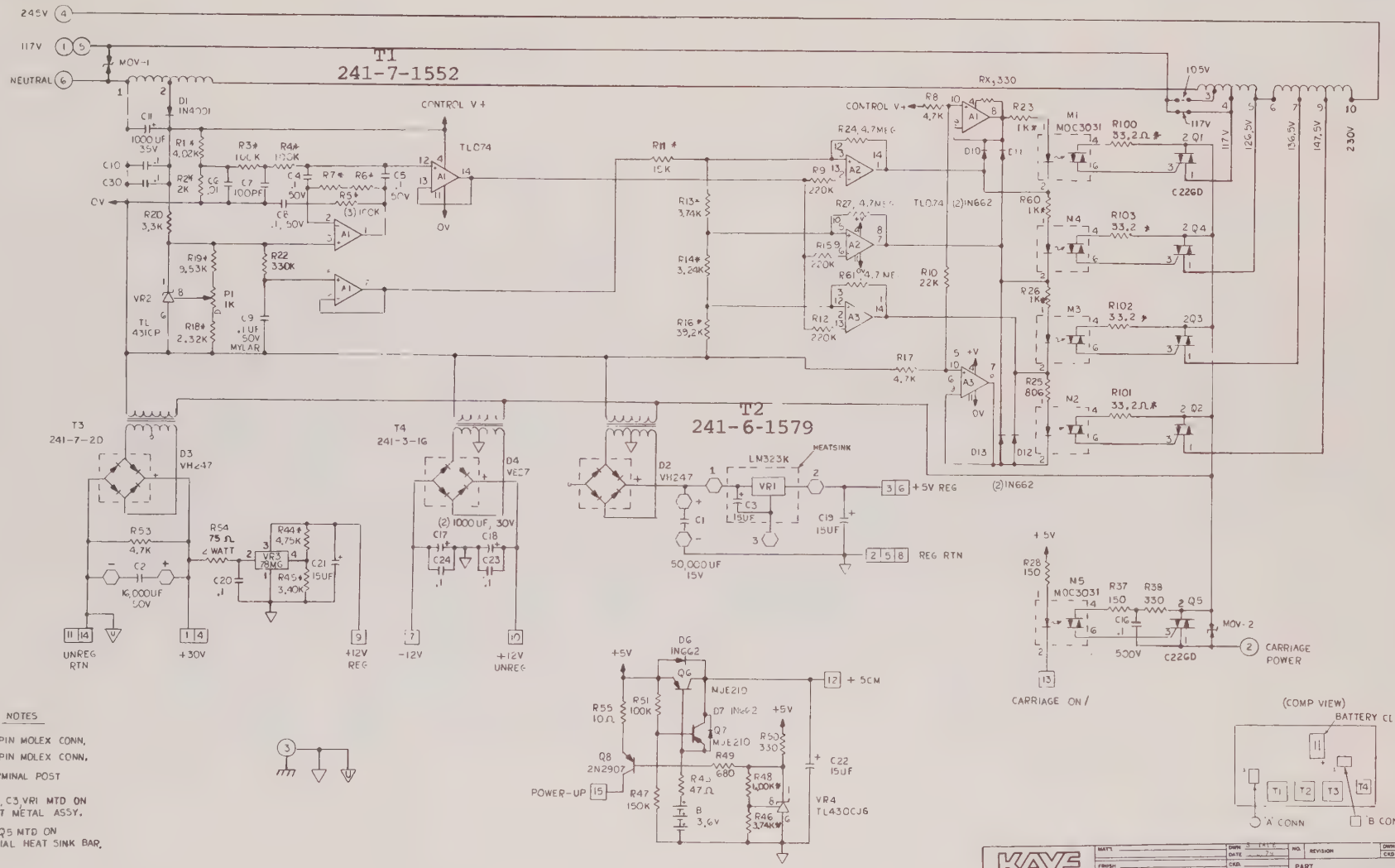

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SECTION 5 - TROUBLESHOOTING

5.1 Introduction

The Digistrip III is made up of a series of plug-in circuit boards and mechanical assemblies. In order to provide a simplified means of troubleshooting the instrument, the information contained in this section describes the isolation and correction of problems at the circuit board and mechanical assembly level only. For information regarding troubleshooting at the component level, contact Kaye Instruments' Customer Service Department in Bedford, Mass.

The information contained in Section 5 consists of a Troubleshooting Diagnostic Table and a series of test procedures. The Troubleshooting Diagnostic Table is used as the starting point for the isolation and correction of Digistrip III operating problems. The leftmost column of the table lists the symptoms of a variety of problems; the middle column lists the most common sources of each problem. The rightmost column provides a test procedure reference for each symptom. To isolate a problem, first locate the symptom in the leftmost column, then read across the table to determine the possible sources and appropriate test procedure reference. As the test procedure is carried out, the source of the problem likely will be revealed and appropriate corrective action recommended.

5.2 TROUBLESHOOTING DIAGNOSTIC TABLE

Problem	Possible Sources of Problem	Test Procedure (Section Reference)
Printhead Will Not Move	-Platen -Carriage Motor -Print Control Board -Power Supply	5.3.1
Printhead Moves to One Side and Stops	-Print Control Board -Power Supply -Data Acquisition Board	5.3.2
Printhead Moves Back and Forth Continuously	-Printhead -Print Control Board	5.3.3
Printhead Tears Paper	-Platen -Print Control Board	5.3.4
Printout Appears Backward	-Printer Assembly -Print Control Board	5.3.5
Printout is Missing Parts of Lines and/or Contains Incorrect Characters	-Print Control Board -Timing Fence -Data Acquisition Board	5.3.6
Printout is Missing Parts of Characters	-Printhead -Print Control Board	5.3.7
Printhead Moves But Paper Does Not Advance	-Paper Take-up Motor -Print Control Board	5.3.8
Instrument is Completely Inoperative	-Power Supply -Data Acquisition Board -Print Control Board	5.3.9
One or More Segments of Display Panel are Inoperative	-Data Acquisition Board -Digital Display Board	5.3.10

5.2 TROUBLESHOOTING DIAGNOSTIC TABLE (continued)

Problem	Possible Sources of Problem	Test Procedure (Section Reference)
Main Fuse Blows Repeatedly	-Carriage Motor -Power Supply	5.3.11
Instrument Power Fails Intermittently	-Power Supply -Data Acquisition Board	5.3.12
One or More Keyboard Keys are Inoperative	-Control Panel -Data Acquisition Board	5.3.13
Instrument Loses or Gains Time and/or Loses Program Information	-Data Acquisition Board -Batteries -Power Supply	5.3.14
All Channels Read OVERRANGE or OPEN	-Analog Board -Channel Access Board	5.3.15
Some Channels Read OVERRANGE or OPEN	-Channel Access Baord -Analog Board	5.3.16
Data Values Drift	-Channel Access Board -Analog Board	5.3.17
Data Values are Incorrect	-Calibration -Analog Board -Channel Access Board -Data Acquisition Board	5.3.18
Even and/or Odd Relays Do Not Operate Properly	-Print Control Board -Data Acquisition Board	5.3.19
Input and/or Output Ports Do Not Operate Properly	-Data Acquisition Board -Print Control Board	5.3.20
Printhead Moves Erratically and/or Squeaks	-Printhead Drive Assembly	5.3.21

5.3 Test Procedures

5.3.1 Printhead Will Not Move

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set
- Volt/Ohm Meter

Test Procedure

1. If the printhead appears to be jammed against the platen, turn the power switch OFF, refer to Section 5.3.4, and check out the printhead-to-platen clearance at the point where the printhead is located. If necessary, adjust, straighten or replace the platen. Once the printhead-to-platen clearance is properly adjusted, if the printhead still will not move, proceed to step 2 below.

2. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

3. Remove the paper from the printer.

4. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

5. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Sections 3.5 and 3.4.

6. Examine the chassis interior and locate the carriage motor. This motor is mounted in the upper right front corner of the chassis.

7. Disconnect the carriage motor power cable by unplugging its two-pin Molex connector. This connector is located in the lower right rear corner of the chassis.

8. Measure the resistance of the carriage motor by connecting the volt/ohm meter lead wires to the two male pins of the Molex connector. This measurement should be 25 to 30 ohms.

9. If the resistance measurement is less than 25 ohms, the carriage motor probably is defective and in need of replacement. For the carriage motor exchange procedure, see Section 3.8.

10. After checking out the carriage motor resistance, reconnect the two-pin Molex connector.

11. If the carriage motor resistance checks out OK, refer to Section 3.12 and check out the printhead drive assembly to make sure that the drive chain, drive pin, and drive gears are properly installed and adjusted.

12. Remove the black metal cover plate from the print control board (right side of chassis).

13. Reconnect the power cord, turn the power switch ON and use the volt/ohm meter to check for the prescribed voltages (as listed below) on the print control board.

Capacitor Identification	Capacitor Location on Print Control Board	Prescribed Voltage
C20	Upper Center Area	+5.0 VDC (±0.2)
C39	Right Center Area	-12.0 VDC (±1.2)
C40	Upper Right Corner	+12.0 VDC (±1.2)

14. If the prescribed voltages are within the specified limits, but the printhead still will not move, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

15. If the prescribed voltages are not present, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

16. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.2 Printhead Moves to One Side and Stops

Test Equipment Required

- Volt/Ohm Meter
- Phillips Screwdriver
- Small Regular Screwdriver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Locate the two test pins labeled J1; these pins are mounted in the lower center area of the print control board.

4. With the Digistrip's power switch still turned OFF, use a small screwdriver to short across test pins J1. When doing this, take precautions to assure that the screwdriver does not make electrical contact with any other points.

5. With test pins J1 shorted, turn the Digistrip's power switch ON. This action will cause the print control board to initiate the printout of a test pattern containing all possible characters.

6. If the test pattern prints out satisfactorily, proceed to step #8.

7. If the test pattern does not print out, the print control board probably is defective and should be exchanged. For the print control board exchange procedure, see Section 3.4.

8. If the test pattern prints out, remove the screwdriver from between test pins J1 and turn the Digistrip's power switch OFF.

9. Turn the power switch back ON and use the volt/ohm meter to check for the prescribed voltages (as listed below) on the print control board.

Capacitor Identification	Capacitor Location on Print Control Board	Prescribed Voltage
C20	Upper Center Area	+5.0 VDC (±0.2)
C39	Right Center Area	-12.0 VDC (±1.2)
C40	Upper Right Corner	+12.0 VDC (±1.2)

10. If the prescribed voltages are not present, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

11. If the prescribed voltages are present, the data acquisition board probably is defective and should be exchanged. For the data acquisition board exchange procedure, see Section 3.5.

12. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.3 Printhead Moves Back and Forth Continuously

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. With the PROGRAM/RUN switch set in the PROGRAM position, turn the power switch ON. Under normal operating conditions, when the power switch is turned ON, the printhead moves across the page area one time and stops. If the printhead moves back and forth continually, proceed to step #4.

4. Locate potentiometer P2 which is mounted in the upper front corner of the print control board.

5. Using a small screwdriver, turn P2 clockwise until it starts making a clicking sound. This sound indicates the end of its adjustment range. Next, set P2 at the approximate center of its adjustment range by turning it counterclockwise eight revolutions. Once this center point is reached, attempt to stop the continual printhead movement by gradually turning P2 clockwise or counterclockwise a maximum of five revolutions from the center point.

   Note: For details on precision adjustment of the print control board, see Section 3.4.

6. If adjustment of P2 does not cause the printhead to stop moving, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

7. If adjustment of potentiometer P2 causes the printhead to stop its continual back and forth movement, a special test mode may be used to check for proper printer operation. This test mode is described below.

8. In preparation to conduct the special printer test, turn the Digistrip's power switch OFF, set the PROGRAM/RUN switch in the RUN position, and locate the two test pins labeled J1. These test pins are mounted in the lower center area of the print control board.

9. With the Digistrip's power switch turned OFF, use a small screwdriver to short across test pins J1. When doing this, take precautions to assure that the screwdriver does not make electrical contact with any other points.

10. With test pins J1 shorted, turn the Digistrip's power switch ON, then remove the screwdriver. This action will cause the print control board to initiate the printout of a test pattern containing all possible characters.

11. Once it has been determined that the printer is operating properly, the special test mode may be discontinued and the printer returned to normal operation by turning the power switch OFF, then back ON.

12. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.4 Printhead Tears Paper

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set
- Feeler Gauge
- Flashlight

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the instrument forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. While aiming a lighted flashlight at the printhead from above, examine the printhead from beneath the chassis and check for any protruding print hammers. These hammers resemble thin wires. If one or more hammers are protruding, the printhead probably is defective and in need of exchange. For the printhead exchange procedure, see Section 3.3.

4. If step #3 revealed no protruding hammers, momentarily turn the power switch ON. This action will cause the printhead to move to one end of the carriage and stop. When the printhead stops, turn the power switch OFF.

5. With the printhead positioned at one end of the carriage, use the feeler gauge to check the printhead-to-platen clearance. This clearance should be 0.015 inches. If the clearance is not 0.015 inches, adjust the platen position to provide the proper clearance at that end of the carriage.

   Note: When checking and adjusting the platen position, always make sure that its printing face is vertically aligned.

6. After checking and adjusting the clearance at one end of the carriage, momentarily turn the power switch ON. This action will cause the printhead to move to the other end of the carriage. One the printhead stops in its new position, turn the power switch OFF.

7. Check and, if necessary, adjust the printhead-to-platen clearance at this end of the carriage to be 0.015 inches.

8. Using the power switch, move the printhead back and forth again and double check the printhead-to-platen clearance at both ends of the carriage.

9. Check out the printing face of the platen for cleanliness and smoothness. If this face is dirty or rough, remove the platen from the instrument, rub down the printing face with crocus cloth or fine steel wool, and replace the platen.

10. After carrying out steps #1-9 above, reinstall the paper into the instrument and check out the printhead for proper operation.

11. If the printhead continues to tear the paper, check for a warp in the platen. To do this, turn the power switch ON, then, as the printhead moves across the carriage, turn the power switch off. This will cause the printhead to stop in the middle of the carriage. Then use the feeler gauge to check the printhead-to-platen clearance at that point. If the clearance is not 0.015 inches, the platen probably is warped and in need of replacement.

12. If the printhead continues to tear the paper after all of the above actions have been taken, the print control board probably is defective and in need of exchange. For the print control board exchange procedure, see Section 3.4.

13. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.5 Printout Appears Backward

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Section 3.5 and 3.4.

5. With the paper guide and upper paper tray removed, refer to Sections 3.9 and 3.12 and check out the printer assembly to make sure that the drive chain, drive pin, drive gears and optical timing fence are properly installed and adjusted. If any adjustments are needed, they should be made at this time.

6. After checking out the printer assembly, connect the instrument's power cord to a line voltage outlet, turn the power switch ON, and check out the printer for proper operation.

7. If, after checking out the printer assembly, the printout still appears backward, refer to Section 3.4 and carry out the print control board adjustment procedure.

8. If, after carrying out the print control board adjustment procedure, the printout still appears backward, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

9. Once the printer malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.6 Printout is Missing Parts of Lines and/or Contains Incorrect Characters

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Locate the two test pins labeled J1; these pins are mounted in the lower center area of the print control board.

4. With the Digistrip's power switch still turned OFF, use a small screwdriver to short across test pins J1. When doing this, take precautions to assure that the screwdriver does not make electrical contact with any other points.

5. With test pins J1 shorted, turn the Digistrip's power switch ON, then remove the screwdriver. This action will cause the print control board to initiate the printout of a test pattern containing all possible characters.

6. If the test pattern does not print out satisfactorily, either the print control board or the timing fence probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4. For the timing fence exchange procedure, see Section 3.9.

7. If the test pattern does print out satisfactorily, the data acquisition board probably is defective and in need of exchange. For the data acquisition board exchange procedure, see Section 3.5.

8. Once the printer malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.7 Printout is Missing Parts of Characters

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver
- Volt/Ohm Meter

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Using the volt/ohm meter, check the continuity of the seven print hammer fuses (fuses F1 through F7) located near the lower front corner of the print control board.

4. Replace any blown fuses with 1 amp Fast-Flo fuses.

5. After replacing all blown fuses, turn the Digistrip's power switch ON and check out the printer for proper operation. If the fuses blow again, the printhead probably is defective and in need of replacement. For the printhead exchange procedure, see Section 3.10.

6. If no blown fuses are found during the above checkout procedure, but information continues to be printed out with parts of characters missing, either the printhead or the print control board probably is defective and in need of replacement. For the printhead exchange procedure, see Section 3.10. For the print control board exchange procedure, see Section 3.4.

7. Once the printer malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.8 Printhead Moves But Paper Does Not Advance

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Using the volt/ohm meter, check the continuity of fuse F8 located near the upper front corner of the print control board.

4. If fuse F8 is blown, replace it with a 1 amp Slo-Blo fuse. After replacing the blown fuse, turn the Digistrip's power switch ON and check to see if the printer is operating normally. If fuse F8 blows again, the paper feed motor probably is defective and in need of replacement. For the paper feed motor exchange procedure, see Section 3.11.

5. If the above check-out reveals that fuse F8 is not blown, check out the black-six-pin connector located at the back of the print control board. In order for the printer to work properly, the two parts of this connector must be tightly connected.

6. If both fuse F8 and the six-pin connector check out OK, either the print control board or the paper feed motor probably is defective and in need of exchange. For the print control board exchange procedure, see Section 3.4. For the paper feed motor exchange procedure, see Section 3.11.

7. Once the printer malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.9 Instrument Is Completely Inoperative

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, check the condition of the Digistrip's main fuse. This fuse is mounted on the instrument's back door. If the main fuse is blown, replace it with a 1.5 amp Slo-Blo fuse (0.75 amp Slo-Blo fuse for 230 VAC systems).

2. After replacement of a blown fuse, connect the power cord to a live voltage outlet, turn the power switch ON, and check out the instrument for normal operation (i.e. illumination of display panel, normal operation of printer, etc.). If the fuse blows again when the power switch is turned ON, the power supply probably is defective and in need of exchange. For the power supply exchange procedure, see Section 3.2.

3. If the main fuse checks out OK, but the instrument still remains inoperative when powered-up, turn the power switch OFF and proceed with step #4.

4. With the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

5. Remove the paper from the printer.

6. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis - rear edge first.

7. Locate the two Molex cable connectors on the left and right sides of the power supply. Check out these connectors to make sure that the two parts of each connector are properly aligned and tightly fitted together.

8. Remove the black metal plate covering the data acquisition board (left side of chassis).

9. Locate the blue coupling capacitor labeled C40; this capacitor is mounted near the lower rear corner of the data acquisition board.

10. Turn the Digistrip's power switch ON and measure the voltage across capacitor C40. To do this, connect the volt/ohm meter probe to the left side of C40 and connect the ground wire to the right side of C40. With the power ON, the voltage across C40 should be +5V (±0.2V).

11. If the +5V (±0.2V) reading is present across C40 and the Digistrip is still inoperative, the data acquisition board probably is defective and in need of exchange. For the data acquisition board exchange procedure, see Section 3.5.

12. If the +5V (±0.2V) reading is not present across C40, turn the power switch OFF and disconnect the bottom cable connector from the rear edge of the data acquisition board.

13. Remove the black metal cover plate from the print control board (right side of chassis).

14. Locate the capacitor labeled C20; this capacitor is mounted in the upper center area of the print control board.

15. Turn the Digistrip's power switch ON and measure the voltage across capacitor C20. To do this, connect the volt/ohm meter probe to the top of C20 and connect the ground wire to the bottom of C20. With the power ON, the voltage across C20 should be +5V (±0.2V).

16. If the +5V (±0.2V) reading is present across C20, and the Digistrip is still inoperative, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

17. If the +5V reading is not present across C20, the power supply probably is defective and in need of replacement. For the power exchange provedure, see Section 3.3.

18. Once the Digistrip's malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.10 One or More Segments of Display Panel are Inoperative

Test Equipment Required

- Phillips Head Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis).

3. Locate the ribbon cable connector mounted in the upper front corner of the data acquisition board. Check out this connector to make sure that its two parts are properly aligned and tightly fitted together.

4. If the ribbon cable is properly connected and one or more segments of the front panel display still are inoperative, either the data acquisition board or the digital display board probably is defective and in need of exchange. For the data acquisition board exchange procedure, see Section 3.5. For the digital display board exchange procedure, see Section 3.13.

5. Once the display panel malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.11 Main Fuse Blows Repeatedly

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Locate the carriage motor power cable and unplug its two-pin Molex connector. This connector is located in the lower right rear corner of the chassis.

5. Using the volt/ohm meter, measure the resistance across the male pins of the connector segment attached to the carriage motor. The resistance reading should be 25 to 30 ohms.

6. If the resistance reading is below 25 ohms, the carriage motor probably is defective and in need of exchange. For the carriage motor exchange procedure, see Section 3.8.

7. If the resistance reading is satisfactory, the power supply probably is defective and in need of exchange. For the power supply exchange procedure, see Section 3.3.

8. After carrying out the steps listed above, reconnect the two-pin Molex connector, install a new 1.5 amp Slo-Blow fuse, connect the power cord to a line voltage outlet, turn the power switch ON and check out the instrument for proper operation.

9. Once the Digistrip's malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.12 Instrument Power Fails Intermittently

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Locate the power supply and make the power supply adjustment according to the procedure described in Section 3.2.

5. With the power supply properly adjusted and the power switch turned OFF, remove the black metal plate covering the data acquisition board (left side of chassis).

5. Locate the blue coupling capacitor labeled C40; this capacitor is mounted near the lower rear corner of the data acquisition board.

6. Turn the Digistrip's power switch ON and measure the voltage across the capacitor C40. To do this, connect the volt/ohm meter probe to the left side of C40 and connect the ground wire to the right side of C40. With the power ON, the voltage across C40 should be +5V (±0.2V)

7. If the +5V (±0.2V) reading is irregular, or outside of the prescribed range, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

8. If the problem persists once a properly operating power supply is installed, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

9. Once the intermittent power failure problem has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.13 One or More Keyboard Keys Are Inoperative

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis).

3. Locate the ribbon cable connector mounted in the upper front corner of the data acquisition board. Check out this connector to make sure that its two parts are properly aligned and fitted together.

4. If the keyboard still malfunctions when the ribbon cable is properly connected, either the keyboard or the data acquisition board probably is defective and in need of replacement. For the keyboard exchange procedure, see Section 3.14. For the data acquisition board exchange procedure, see Section 3.5.

5. Once the keyboard malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.14 Instrument Loses or Gains Time and/or Loses Program Information

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis).

3. Locate the zener diode labeled Z1 on the data acquisition board; Z1 is mounted beneath the PROMs, near the lower front corner of the board.

4. Using the volt/ohm meter, check the voltage across Z1. This is done by connecting the meter's probe to the right side of Z1 and connecting the ground wire to the left side of Z1. The voltage across Z1 is representative of the voltage supplied from the power supply battery pack the CMOS memory chips. At all times, this voltage should be in the range +3.5V to +5.0V.

5. If the voltage across Z1 checks out OK, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

6. If the voltage across Z1 is not in the proper range, check out, and, if necessary, charge or replace the three rechargable AA batteries located on the power supply. Replacement batteries must be of the NI/CAD rechargable type.

7. If uncharged batteries are present in the power supply, these batteries should be allowed to charge in the instrument for at least 14 hours. The battery charging process continues whenever the Digistrip is connected to a line voltage supply and the power switch is turned ON.

8. If the problem persists after the above steps have been carried out, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

9. Once the problem has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.15 All Channels Read OVERRANGE or OPEN

This problem usually is caused by a program error, a defective analog board, or a defective channel access board. The tests for all of these defect conditions are included in the defective board isolation procedures described in Section 3.7.

5.3.16 Some Channels Read OVERRANGE or OPEN

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. With the Digistrip's power cord connected to a line voltage outlet, the power switch turned ON and the PROGRAM/RUN switch set in the PROGRAM position, initiate a printout of complete program information by pressing the LIST PROGRAM key.

2. Once the program printout is completed, review it carefully to make sure that all programmed instructions are accurate and complete.

3. With the instrument still set in the program mode, assign function 01 (the 65 mv DVM measuring scale) to all channels reading OVERRANGE or OPEN.

4. Short out the inputs of the problem channels by connecting jumper wires across each channel's input terminals.

5. Move the PROGRAM/RUN switch to the RUN position and call up the displayed value of each problem channel.

6. If the displayed values of the problem channels now read approximately 00.000mv, the software probably is operating properly and the problem probably is the result of program errors.

7. To correct any program errors, return the PROGRAM/RUN switch to the PROGRAM position and reprogram the desired operating instructions for the problem channels.

8. Next, move the PROGRAM/RUN switch to the RUN position and again check out the displayed values of these channels.

9. If the problem channels still read OVERRANGE or OPEN, initialize and reprogram the instrument.

10. After reprogramming the instrument, again check out the displayed values of the problem channels. If these channels still read OVERRANGE or OPEN, proceed to step #11.

11. Turn the power switch OFF, open the rear door and locate the analog board mounted inside the instrument.

12. Remove the black metal cover from the analog board and locate the neon bulb mounted in the lower left corner of the board.

13. Short out the neon bulb by connecting a jumper across its lead wires.

14. Turn the power switch ON, move the PROGRAM/RUN switch to the PROGRAM position, and assign function 01 to each problem channel.

15. Move the PROGRAM/RUN switch to the RUN position and call up the displayed value of each problem channel. If these channels now read approximately 00.000, the analog board is working correctly and the problem probably is the result of a defective channel access board. For the channel access board exchange procedure, see Section 3.7.

16. If the values displayed in step #15 (above) for the problem channels still read OVERRANGE or OPEN, the analog board probably is defective and in need of replacement. For the analog board exchange procedure, see Section 3.6.

17. Once the instrument malfunction has been corrected, reprogram the problem channels with the desired function numbers, disconnect the input terminal jumpers, close up the instrument, and resume normal monitoring operations.

5.3.17 Data Values Drift

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. Connect the Digistrip's power cord to a line voltage outlet, turn the power switch ON and set the PROGRAM/RUN switch in the PROGRAM position.

2. With the instrument set in the program mode, assign function 01 (the 65 mv DVM measuring range) to all problem channels.

3. Turn the power switch OFF.

4. Open the rear door and locate the analog board mounted inside the instrument.

5. Remove the black metal cover plate from the analog board and locate the neon bulb mounted in the lower left corner of the board.

6. Short out the neon bulb by connecting a jumper across its lead wires.

7. Turn the power switch ON and set the PROGRAM/RUN switch in the RUN position.

8. Call up the displayed value of each problem channel. If these values read approximately 00.000 mv and do not drift by more than 6μv, one or more channel access boards probably are defective and in need of replacement. For the channel access board exchange procedure, see Section 3.7.

9. If the values displayed for the problem channels in step #8 above are other than approximately 00.000, or if they are approximately 00.000, but drift by more than 6 mv, the analog board probably is defective and in need of replacement. For the analog board exchange procedure, see Section 3.6.

10. Once the malfunction has been corrected, reprogram the problem channels with the desired function numbers, disconnect the jumper from the neon bulb on the analog board, close up the instrument, and resume normal monitoring operations.

5.3.18 Data Values Are Incorrect

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. Connect the Digistrip's power cord to a line voltage outlet, turn the power switch ON and set the PROGRAM/RUN switch in the PROGRAM position.

2. Initiate a complete program printout by pressing the LIST PROGRAM key.

3. Once the program printout is completed, examine it carefully to make sure that all programmed instructions are accurate and complete. If any program changes are needed, they should be made at this time.

4. If the temperature readings or other output data values are incorrect by a few degrees, millivolts, etc., the instrument may be in need of calibration. For the calibration procedures, see Section 2.

5. If the output data values are totally incorrect, or if the outputs cannot be properly calibrated, the analog board probably is defective and in need of exchange. For the analog board exchange procedure, see Section 3.6.

6. If the output data values are still incorrect once a properly operating analog board is installed in the system, proceed to step #7 below.

7. With the instrument still set in the program mode, assign function 01 (the 65 mv DVM measuring scale) to several randomly selected test channels.

8. Turn the Digistrip's power switch OFF, open the rear door and locate the analog board mounted inside the instrument.

9. Remove the black metal cover plate from the analog board and locate the neon bulb mounted in the lower left corner of the board.

10. Short out the neon bulb by connecting a jumper across its lead wires.

11. Turn the power switch back ON and set the PROGRAM/RUN switch in the RUN position.

12. Call up the displayed value of each test channel to which function 01 is assigned. If the value of each channel is approximately 00.000 mv, one or more channel access boards probably is defective and in need of replacement. For the channel access board exchange procedure, see Section 3.7.

13. If the test channel values displayed in step #12 above are other than approximately 00.000 mv, the analog board probably is defective and in need of replacement. For the analog board exchange procedure, see Section 3.6.

14. If the problem of incorrect output values persists once properly operating channel access and analog boards are installed in the system, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

15. Once the system malfunction has been corrected, reprogram the desired function numbers into the test channels, disconnect the jumper from the neon bulb on the analog board, close up the instrument and resume normal monitoring operations.

5.3.19 Even and/or Odd Relays Do Not Operate Properly

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. Connect the Digistrip's power cord to a line voltage outlet, turn the power switch ON and set the PROGRAM/RUN switch in the PROGRAM position.

2. Check out the relay installation to make sure that it is properly set up and connected to the Digistrip.

3. Initiate a complete program printout by pressing the LIST PROGRAM key.

4. Once the program printout is completed, examine it carefully to make sure that all programmed instructions are accurate and complete. Pay particular attention to the programmed relay operating instructions and configuration numbers. If any program changes are needed, they should be made at this time.

5. Once the program has been checked out and corrected as needed, if the relays still do not work properly, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

6. If the relay malfunction persists once the above steps have been carried out, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

7. Once the relay malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.20 Input and/or Output Ports Do Not Operate Properly

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Locate the baud rate selection jumper mounted on the data acquisition board (left side of chassis). This jumper is accessible through a cut-out in the black metal cover plate.

3. By appropriate positioning of the baud rate jumper, the data transmission rate of the Digistrip may be set at 150, 300, 600, 1200, or 2400 baud. In order to assure data transmission compatibility between the Digistrip and other equipment, make sure that the baud rate settings of the Digistrip and all peripheral devices are the same.

4. Check out all input and output connections on the back of the Digistrip and make sure that they are properly installed.

5. Turn the power switch ON, set the PROGRAM/RUN switch in the PROGRAM position and initiate a complete program printout by pressing the LIST PROGRAM key.

6. Once the program printout is completed, examine it carefully to make sure that all programmed instructions are accurate and complete. Pay particular attention to the configuration numbers. If any program changes are needed, they should be made at this time.

7. Set the PROGRAM/RUN switch in the RUN position and call up the display of data for several channels. If, after carrying out steps #1 through #6 above, the problem with the input and/or output ports persists, either the data acquisition board or the print control board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5. For the print control board exchange procedure, see Section 3.4.

8. Once the system malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.21 Printhead Moves Erratically and/or Squeaks

Conditions causing the printhead to move erratically and/or squeak usually are the result of problems with the printhead drive assembly. For the printhead drive assembly checkout, adjustment and lubrication procedure, see Section 3.12.

Section 6 - Packing and Shipping

The carton in which each Digistrip III is shipped from the factory is designed to adequately protect the instrument from damage during transit. It is important that similar packaging be utilized whenever a Digistrip must be shipped. The following paragraphs outline proper packing and shipping procedures.

Boxes or crates used to transport a Digistrip should be constructed of double wall corrugated paper or wood. They should be six inches larger in each dimension than the instrument to allow room for packing material. Corrugated boxes should be secured with reinforced packing tape.

The Digistrip should be placed in the box with corner blocks of high density foam or multilayered corrugated paper to prevent it from shifting during transit. Failure to do this will allow the instrument to shift its position in the container, making it prone to damage from impact. To further protect the Digistrip during shipping, tape a square of cardboard over the front door window, and fill the space around the instrument with plastic foam "peanuts."

To expedite handling of the Digistrip by the receiver, attach a label to the top of the instrument indicating your company name and address, the destination, and a description of the instrument and any inclusions such as keys or manuals. If the Digistrip is being returned to Kaye Instruments for service, be sure to include the Return Authorization number obtained from Kaye's Customer Service Department.

If frequent shipments are anticipated, use of a reshippable container (Kaye Item # M0155) is recommended. This specially designed case has a custom formed interior designed to safely hold the instrument, its power cord, and user guides. It is suitable for air or motor freight transport.

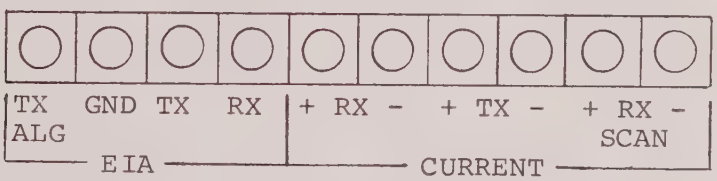
Section 7 - Serial Data Interfacing

7.1 General Information

The Digistrip III is capable of communicating in ASCII-encoded serial data with a variety of peripheral devices. These devices include computers, CRT terminals, cassette recorders, remote scanners, etc. Depending upon the application involved, serial data may be transmitted or received in either EIA RS-232C, or TTY-type 20 ma current loop format. When the current loop format is used, the Digistrip acts as a passive transmitting and receiving device.

A group of serial data connection terminals are mounted on the Digistrip's rear door panel. These terminals are shown in the figure below. EIA RS-232C terminals are provided for communication with a computer, or other peripheral devices. A special RS-232C terminal (labeled TX ALG) is provided for the continuous transmission of processed output data for a specified group of 16 source channels to a Model AO-16 Analog Output Module. TTY-type current loop terminals also are provided for communication with a computer or other peripheral devices. A special set of current loop terminals (labeled RX SCAN) are provided for the receipt of data from remote digital and analog scanners. The table on page 7-2 provides detailed information on the connections to be used for various types of serial data communication.

Serial Data Connection Terminals



Serial Data Interface Connections

Connect Digistrip III terminals to peripheral device terminals as indicated below:

Digistrip III Connection Terminals	Peripheral Device Connection Terminals: Computer Terminal (EIA)	CPU/ Modem (EIA)	RAMP/ Scanner (TTY)*	Current Loop (TTY) Device	RD-48 Relay Driver
TX ALG (EIA)	--	--	--	--	--
GND (EIA)	Pin 7	Pin 7	--	--	--
TX (EIA)	Pin 3	Pin 2	--	--	--
RX (EIA)	Pin 2	Pin 3	--	--	--
RX+ (TTY)	--	--	Pin 4	TX+	--
RX- (TTY)	--	--	Pin 12	TX-	--
TX+ (TTY)	--	--	--	RX+	RX+
TX- (TTY)	--	--	--	RX-	RX-
RX SCAN+ (TTY)	--	--	--	--	--
RX SCAN- (TTY)	--	--	--	--	--
ODD RELAY--COM	--	--	--	--	--
ODD RELAY--NC	--	--	--	--	--

*When connecting a RAMP/Scanner to a Digistrip III, make sure that a jumper is installed between Pins 3 and 13 on the connection cable.

Digistrip III Connection Terminals	Peripheral Device Connection Terminals: Cassette Program Loader	MFE-2500 Digital Recorder	AO-16 (Single Scanner)	AO-16 (Multiple Scanners)	FS-8/ DS-8 Scanners
TX ALG (EIA)	--	--	RX	--	--
GND (EIA)	GND	Pin 7	GND	--	--
TX (EIA)	RX	Pin 2	--	--	--
RX (EIA)	TX	Pin 3	--	--	--
RX+ (TTY)	--	--	--	--	--
RX- (TTY)	--	--	--	--	--
TX+ (TTY)	--	--	--	RX+	--
TX- (TTY)	--	--	--	RX-	--
RX SCAN+ (TTY)	--	--	--	--	TX+
RX SCAN- (TTY)	--	--	--	--	TX-
ODD RELAY--COM	--	--	--	--	RX+
ODD RELAY--NC	--	--	--	--	RX-

The baud rate of the Digistrip must be matched to that of the peripheral devices with which it is communicating. The baud rate of the special EIA analog output terminal (labeled TX ALG) and that of the special current loop remote scanner input terminal pair (labeled RX SCAN) are fixed at 1200. The baud rate of the other serial data terminals must be defined by appropriate setting of the baud rate jumper. This jumper is located near the left rear corner of the data acquisition board (left side of chassis). The baud rate jumper may be set for 150, 300, 600, 1200, or 2400 baud. Whenever the baud rate of the Digistrip is to be changed, it must be done when the instrument's power switch is turned OFF.

The Digistrip generates data in a line format suitable for use by its internal printer. Each line consists of 137 characters, followed by a carriage return and line feed command. Each character is made up of one start bit, seven data bits, one even parity bit, and one stop bit. The character transmission rate is equal to the baud rate divided by 10.

7.2 Serial Data Interface Options

The operating parameters of a Digistrip III are defined by programming Configuration Numbers 1, 2, 3, and 4. Details on Configuration Number programming are provided on pages 29-34 of the Digistrip III User's Guide. Many of the Digistrip's operating parameters relate to serial data interfacing. By appropriate specification of the Configuration Number digits, the user may select one or more of the following serial data interface options:

Serial Data Interface Options

- Remote Scanner Inputs
- Single Line Analog Data Outputs
- Verbatim Copy of Digistrip Printout
- User-Defined Serial Data Communication
- Program Offloading and Loading
- Serial Relay Outputs
- Printing Messages from a Computer

7.2.1 Remote Scanner Input

This option is used to enable the receipt of serial data inputs from one or more RAMP/Scanners, FS-8 Frequency Scanners, and/or DS-8 Digital Scanners. Its data transmission rate is fixed at 1200 baud. The Remote Scanner Input option is implemented by specifying digit 2 of Configuration Number 4 to be 4, 5, 6 or 7.

Note: When using a RAMP/Scanner with a Digistrip III, make sure that resistor R13 on the scanner's outguard power supply is a 330Ω, ½W resistor.

7.2.2 Single Line Analog Data Output

This option is used to enable the continuous high speed serial transmission of processed output data from a single group of 16 consecutive channels to an AO-16 Analog Output Module. Its data transmission rate is fixed at 1200 baud. The Single Line Analog Data Output option is implemented by the appropriate specification of digit 5 of Configuration Number 4.

7.2.3 Verbatim Copy of Digistrip Printout

This option is used to enable the transmission of a verbatim copy of all Digistrip printout information to a computer, CRT terminal, external printer, or data storage device. When using this option, the baud rate of the Digistrip must be set to match the baud rate of the peripheral device to which the printout information will be transmitted. The Verbatim Copy of Digistrip Printout option is implemented by specifying digit 4 of Configuration Number 3 to be 4. Whenever this option is enabled, the User-Defined Serial Data Communication option (Section 7.2.4), the Program Offloading and Loading option (Section 7.2.5), and the Serial Relay Output option (Section 7.2.6) are inoperative.

7.2.4 User-Defined Serial Data Communication

This option is used to enable user-defined serial data communication between a Digistrip III and a computer, CRT terminal, external printer, data storage device, etc. Whenever this option is utilized, the baud rate of the Digistrip must be set to match the baud rate of the peripheral devices with which it is to communicate.

When using the User-Defined Serial Data Communication option to transmit data from a Digistrip, the information on any combination of lines may be selected for transmission. The lines to be transmitted are specified by digits 1, 2 and 3 of Configuration Number 3. The data transmissions may be programmed to start upon one or more of the following occurrences:

- External Transmission (Serial Time) Interval Time-Out
- Accumulation Interval Time-Out
- Alarm Occurrence
- Contact Closure Input
- Command from a Computer

Transmission of data at the end of the external transmission interval, the end of the accumulation interval, or upon an alarm occurrence is enabled by the appropriate specification of Digit 5 of Configuration Number 3.

Transmission of data in response to an external contact closure is enabled by specifying digit 3 of Configuration Number 4 to be 2, 3, 6 or 7.

Transmission of data in response to a computer command is enabled by specifying digit 2 of Configuration Number 4 to be 1, 3, 5 or 7, and digit 3 of Configuration Number 4 to be 2, 3, 6 or 7. To initiate the transmission, the computer sends an ASCII DC2 (↑R) character. When enabled as described above, the DC2 command has the same effect as an external contact closure input.

By appropriate specification of digit 4 of Configuration Number 3, the transmitted data may be provided with or without channel numbers. Digit 6 of Configuration Number 3 may be used to specify the transmission of eight channels per line. If the transmission of eight channels per line is not specified, one channel per line will be transmitted when channel numbers are transmitted, and 16 channels per line will be transmitted when channel numbers are not transmitted. The figures on pages 7-7 and 7-8 show examples of the various formats in which channel data may be transmitted.

Data transmissions initiated by an alarm occurence may be printed out in the format described above, or in a single line alarm message format. The alarm message format is described on pages 63-65 of the Digistrip III User's Guide. Single line alarm message transmissions are enabled by specifying digit 4 of Configuration Number 4 to be 1, 3, 5, or 7.

Current time information is always transmitted as part of the first line of data when channel numbers are not transmitted. When channel numbers are transmitted, digit 4 of Configuration Number 3 may be specified to provide the time as the first line of each transmission.

Transmitted Data Printout Example
(8 Channels Per Line With Time)

```
15:34:40   28.0C*  28.0  0.0000  -0.001M   0.01M    0.0M   87.0F  0.002M
          -0.002M -0.002M  0.001M 100.00  10.000  10.000  20.000  200.00
15:34:50   28.0C*  28.0  0.0000   0.000M   0.01M    0.0M   87.0F  0.003M
           0.000M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
15:35:00   28.0C*  28.0  -0.000   0.000M   0.01M    0.0M   87.0F  0.003M
          -0.001M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
```

Transmitted Date Printout Example
(8 Channels Per Line With Channel Numbers)

```
601   28.1C*602   28.1  603 -0.000  604  0.000M 605   0.00M 606    0.1M 607   87.2F 608  0.002M
609 -0.001M 610 -0.003M 611  0.002M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
601   28.1C*602   28.1  603 -0.000  604 -0.001M 605   0.00M 606    0.1M 607   87.2F 608  0.002M
609 -0.001M 610 -0.004M 611  0.003M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
```

Transmitted Data Printout Example
(8 Channels Per Line With Time and Channel Numbers)

```
14:45:40
601   27.9C*602   27.9  603 -0.000  604 -0.001M 605   0.00M 606    0.0M 607   86.8F 608  0.002M
609 -0.002M 610 -0.003M 611  0.002M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
14:45:50
601   27.9C*602   27.9  603 -0.000  604  0.000M 605   0.00M 606    0.0M 607   86.8F 608  0.002M
609 -0.002M 610 -0.003M 611  0.001M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
```

Transmitted Data Printout Example
(16 Channel Per Line With Time)

```
14:51:30  27.8C*  27.8  0.0002  0.001M  0.00M  0.0M  86.6F  0.003M  0.000M -0.001M  0.003M 100.00  10.000  10.000  20.000  200.00
14:51:40  27.8C*  27.8  0.0000  0.000M  0.00M  0.0M  86.6F  0.003M -0.001M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
14:51:50  27.8C*  27.8  0.0000  0.000M  0.01M  0.0M  86.6F  0.003M -0.001M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
14:52:00  27.8C*  27.8  0.0000  0.000M  0.01M  0.0M  86.6F  0.002M -0.002M -0.003M  0.002M 100.00  10.000  10.000  20.000  200.00
14:52:10  27.8C*  27.8  0.0000  0.000M  0.01M  0.0M  86.6F  0.002M -0.001M -0.003M  0.002M 100.00  10.000  10.000  20.000  200.00
14:52:20  27.8C*  27.8  0.0000  0.000M  0.01M  0.0M  86.6F  0.002M -0.001M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
14:52:30  27.8C*  27.8  -0.000  0.000M  0.00M  0.1M  86.6F  0.002M -0.002M -0.003M  0.002M 100.00  10.000  10.000  20.000  200.00
14:52:40  27.8C*  27.8  0.0000  0.000M  0.00M  0.0M  86.6F  0.002M -0.001M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
```

Transmitted Data Printout Example
(One Channel Per Line With Time and Channel Numbers)

```
15:39:10
601   28.0C*
602   28.0
603 -0.000
604 -0.001M
605   0.01M
606    0.0M
607   87.0F
608  0.002M
609 -0.002M
610 -0.003M
611  0.002M
612 100.00
613 10.000
614 10.000
615 20.000
616 200.00
```

Interactive Data Transmission

As a special feature of the User-Defined Serial Data Communication option, the Digistrip III provides interactive data transmission capability. This capability allows for the synchronization of a Digistrip's data transmissions with the processing speed of a computer. When the interactive transmission feature is enabled, the Digistrip waits to transmit information until a DC3 (↑S)character is received from the computer. Each time a DC3 character is received, a single line of data is transmitted. Upon the receipt of a DC3 character, if no data is waiting to be transmitted, the Digistrip disregards the transmission command. The interactive data transmission feature is enabled by specifying digit 6 of Configuration Number 3 to be 1, 3, 5, or 7. Whenever the interactive data transmission feature is enabled, the computer may send an ABORT command at any time during a data transmission. This command terminates the transmission and resets the Digistrip's logic. The ABORT command is an ASCII DC4 (↑T) character.

Serial Transmission Start and End Messages

When Digistrip data outputs are to be transmitted to a computer, it sometimes is necessary to provide transmission Start and End messages as part of the serial data stream. This may be accomplished by programming encoded characters into two special memory locations. Each message may contain up to 31 encoded ASCII characters. These characters may be assigned in any combination desired. Each ASCII character is defined by programming a combination of two hexadecimal keyboard characters. The table below lists the keyboard character combinations available for programming, together with their ASCII equivalents.

Hexadecimal/ASCII Equivalents

00 NUL	20 SP	40 @	60 `
01 SOH	21 !	41 A	61 a
02 STX	22 "	42 B	62 b
03 ETX	23 #	43 C	63 c
04 EOT	24 $	44 D	64 d
05 ENQ	25 %	45 E	65 e
06 ACK	26 &	46 F	66 f
07 BEL	27 '	47 G	67 g
08 BS	28 (	48 H	68 h
09 HT	29)	49 I	69 i
0A LF	2A *	4A J	6A j
0B VT	2B +	4B K	6B k
0C FF	2C ,	4C L	6C l
0D CR	2D -	4D M	6D m
0E SO	2E .	4E N	6E n
0F SI	2F /	4F O	6F o
10 DLE	30 0	50 P	70 p
11 DC1 (X-ON)	31 1	51 Q	71 q
12 DC2 (TAPE)	32 2	52 R	72 r
13 DC3 (X-OFF)	33 3	53 S	73 s
14 DC4 (~~TAPE~~)	34 4	54 T	74 t
15 NAK	35 5	55 U	75 u
16 SYN	36 6	56 V	76 v
17 ETB	37 7	57 W	77 w
18 CAN	38 8	58 X	78 x
19 EM	39 9	59 Y	79 y
1A SUB	3A :	5A Z	7A z
1B ESC	3B ;	5B [	7B {
1C FS	3C <	5C \	7C |
1D GS	3D =	5D]	7D } (ALT MODE)
1E RS	3E >	5E ^ (↑)	7E ~
1F US	3F ?	5F — (←)	7F DEL (RUB OUT)

The serial transmission Start message is programmed into the secondary memory of header fields 901-908; the End message is programmed into the secondary memory of header fields 909-916. These messages are programmed in much the same manner as the alarm messages (see page 63 of the Digistrip III User's Guide). The figure below shows the programming format used.

Serial Transmission Start and End Message Programming Format

To program a Start message, first call up the secondary memory of header field 901. This memory location is accessed by pressing the HEADER key twice. Then, refer to the information above and program the desired message characters. The characters must be programmed in consecutive order, beginning with character position 1 of field 901. Each message must be terminated with a blank. To program an End message, call up the secondary memory of header field 909 and enter the desired message characters in a similar manner.

7.2.5 Program Offloading and Loading

This option provides for the offloading and loading of complete Digistrip III program information. When this option is implemented, programs may be offloaded to a Kaye Model CPL Cassette Program Loader, or a digital cassette recorder such as the MFE Model 2500. Cassette recorded programs may be loaded into a Digistrip III by use of the same equipment. To enable the offloading of program information from a Digistrip, digit 2 of Configuration Number 4 must be specified as 2, 3, 6 or 7. When using the Program Offloading and Loading option, the baud rate of the Digistrip must be set to match that of the recording device.

Details on the procedures used for offloading and loading programs with a Kaye Model CPL Cassette Program Loader are provided with the recorder. Procedures for offloading and loading programs with an MFE Model 2500 are available from Kaye Instruments upon request.

7.2.6 Serial Relay Output

This option is used whenever a Kaye Model RD-48 Relay Driver is to be operated in conjunction with a Digistrip III. Utilizing this option, the relay numbers for all active relays are transmitted continuously (except during data transmissions) whenever the Digistrip is operating in the Run Mode. When the Serial Relay Output option is used, the baud rate of the Digistrip must be matched to that of the Relay Driver. Serial Relay Outputs are implemented by specifying digit 3 of Configuration Number 3 to be 1, 3, 5 or 7. When either the Verbatim Copy of Digistrip Printout option (Section 7.2.3) or the User-Defined Serial Data Communication option (Section 7.2.4) is used in a system without a Relay Driver, digit 3 of Configuration Number 3 must be 0, 2, 4 or 6.

7.2.7 Printing Messages from a Computer

This option allows the Digistrip III to print out single line messages received from a computer. Each message may contain a maximum of 137 characters, termined with a carriage return and line feed command. The Printing Messages from a Computer option is implemented by specifying digit 3 of Configuration Number 2 to be 1, 3, 5 or 7. Before transmitting a message, the computer sends an ASCII DC1 (↑Q) character to test the availability of the Digistrip's printer. If the printer is available for use, the Digistrip responds with an ACK (↑F) character; if not, it responds with an NAK (↑U) character. The computer sends the message only when the Digistrip is ready to receive it.

KAYE INSTRUMENTS

PROCESS MONITORING SYSTEM ACCESSORIES

Kaye Instruments offers two families of process monitoring equipment, Digistrip and RAMP. The following accessories are compatible with both series, with one exception. The Relay Driver and Relay Closure Modules are intended for use on the Digistrip series only.

MODEL FS-8 FREQUENCY SCANNER

The Model FS-8 Frequency Scanner is designed to serve as a remote satellite scanner, transmitting pulse and frequency inputs in digital data form to a RAMP/Processor or Digistrip Recorder. Each microprocessor based scanner is capable of handling 8 input channels. Up to 8 input scanners may be connected in a series or daisy-chained fashion to feed a single input port. Scanners may be remotely located up to 1000 feet from the Digistrip Recorder or RAMP/Processor.

Frequency inputs are measured using a pulse accumulation technique. Pulse counts are periodically transferred to registers and then transmitted as a serial data stream. Digistrip Recorders have a 10 second pulse accumulation interval. The RAMP System has a 7.5 second pulse accumulation interval.

Each input channel is individually jumper-plug selectable for either contact closure (pull-up resistors active) or non-contact closure operation; input voltage threshold level; and filter roll-off frequency.

Channel number switch selection automatically establishes the transmission time segment for this time multiplexed transmitting instrument. Both FS-8 and DS-8 Scanners may be connected in the same daisy-chained transmission line as long as unique channel numbers are selected. A failed unit will automatically switch itself out of the chain permitting other units to transmit normally.

The Digistrip II Recorder will accept up to 16 channels of frequency or digital signal input. The Digistrip III Recorder will accept up to 64 channels of frequency and digital signal input. The RAMP/Processor will accept up to 512 channels of frequency and digital input.

Specifications:

Size: Rack mounting, 19″ wide x 1.75″ high x 12″ deep

Capacity: Eight channels of pulse or frequency input

Frequency Range: 0-10K Hz

Absolute Maximum Rating: +25V, −15V

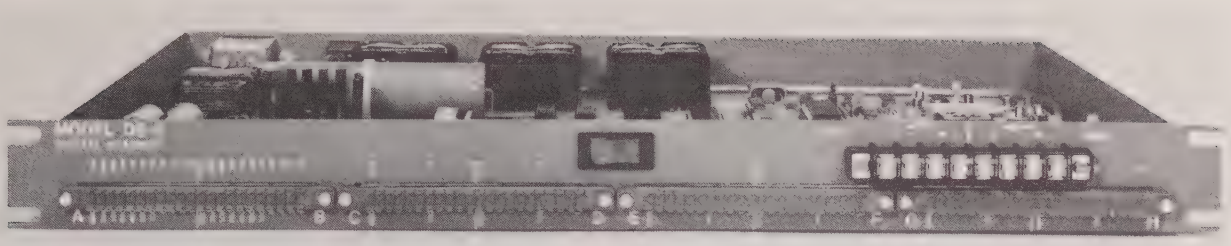
Signal Threshold	Hysteresis
0 V	0.01 V
0.1	0.01
1	0.1
5	0.5
Contact Closure	0.5

Roll-Off Frequencies	Input Impedance
0.02 K Hz	332K
0.2	33.2K
2	3.32K
20	332Ω

Power: Twenty-five watts, 115/230 V, 50/60 Hz

Weight: Five pounds

MODEL DS-8 DIGITAL SIGNAL SCANNER



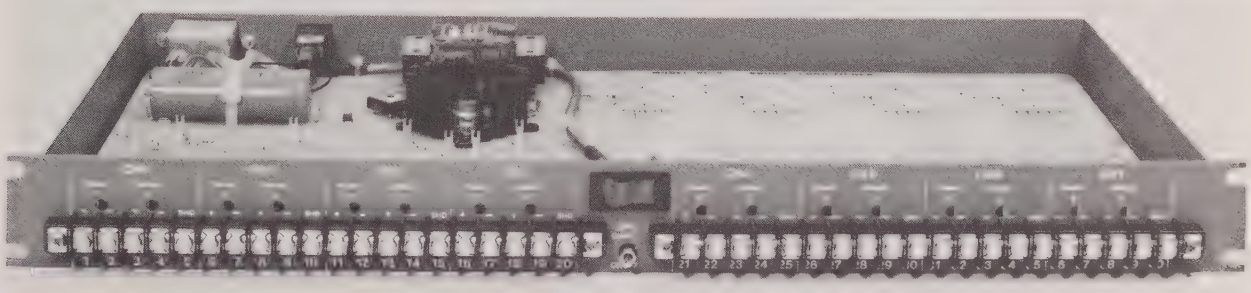
The Model DS-8 Digital Signal Scanner is a microprocessor based 8 channel satellite scanner. It provides a convenient means to acquire both thumbwheel and individual meter generated BCD levels from scales, counters and other direct indicating instruments. Its signal transmission characteristics and system integration requirements are identical to those of the FS-8 Scanner.

Each of the 8 input channels is capable of accepting a maximum count of 65,535. Switches select on a group of 8 basis, either true or complimentary logic, and BCD or binary logic. All input connections are provided with tie-up resistors. All inputs must be TTL logic level compatible (maximum 5.5 V) or contact closures. A common input TTL latch line is provided, latching on low level or contact closure.

Specifications:

Size: Rack mounting, 19″ wide x 1.75″ high x 12″ deep
Capacity: Eight channels BCD or Binary Data
Maximum Count: 65535
Connectors: Cinch 251 •22 •30 •160 or equal.
One set (4) included with each unit.
Power: Thirty watts, 115/230 V, 50/60 Hz
Weight: Five Pounds

MODEL BC-8 BRIDGE CONDITIONER

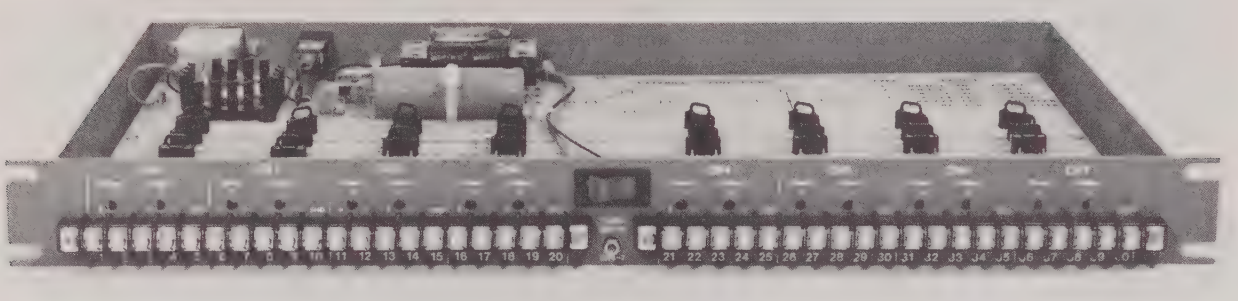


The Model BC-8 Bridge Conditioner provides 8 channels of high quality, moderate cost conditioning for strain gage and RTD applications. Each of the 8 bridge circuits is individually configurable for either ¼, ½, or full bridge operation. All 8 circuits are driven by one main power supply but have individual zero and span adjustments. Bridge excitation is adjustable between 2.8 and 3.2 VDC with a maximum current of 45 ma. Completion resistors are installed at the factory. Bridge configuration and type must be specified at time of order. Shunt calibration is provided by means of a front mounted toggle switch.

Specifications:

Dimensions: Rack mounting, 19″ wide x 1.75″ high x 8″ deep
Bridge Configurations: ¼ bridge 2 and 3 wire, plus shield
½ bridge 3 wire, plus shield
Full bridge 4 wire, plus shield
Bridge Types: 120 ohm and 350 ohm strain gage
10 ohm and 100 ohm RTD
Bridge Excitation: Variable for each bridge from 2.8 — 3.2 VDC
Maximum Current per Bridge: 45 ma
Capacity: Eight bridge circuits, individual completion, zero and span
Power: Fifteen watts, 115/230 V, 50/60 Hz
Weight: 3 pounds

MODEL BC-8SSG STRAIN GAGE BRIDGE CONDITIONER



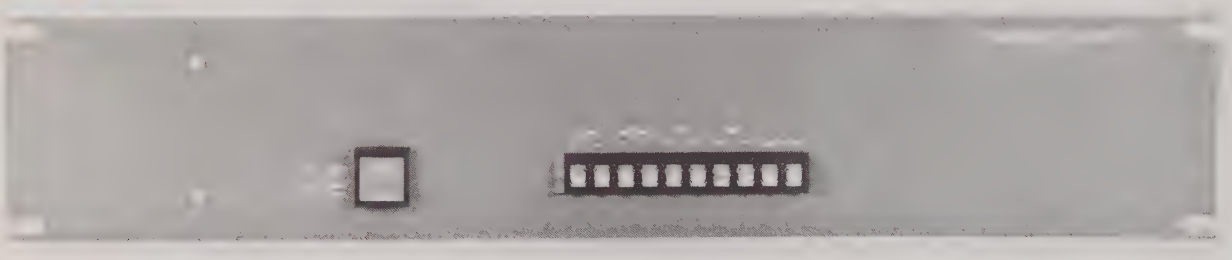
The Model BC-8SSG is a specialized version of the standard Model BC-8. The BC-8 should be used in dedicated applications. The BC-8SSG should be used for test situations where ease of configuration is desirable. Eight conditioning circuits are provided on each BC-8SSG. Each circuit is jumper-plug selectable for use with either 120 ohm or 350 ohm strain gages in either ¼, ½, or full bridge configurations. All completion resistors including shunt calibration resistors are provided on this unit.

Bridge schematic diagrams are screened directly on the circuit board to aid in the selection of various bridge configurations.

Specifications:

Dimensions: Rack mounting, 19″ wide x 1.75″ x 8″ deep
Bridge Configurations: ¼ bridge 2 and 3 wire, plus shield
½ bridge 3 wire, plus shield
Full bridge 4 wire, plus shield
Bridge Excitation: Variable for each bridge from 2.8 — 3.2 VDC
Maximum Current per Bridge: 45 ma
Capacity: Eight bridge circuits, individual zero and span
Power: Fifteen watts, 115/230 V, 50/60 Hz
Weight: 3 pounds

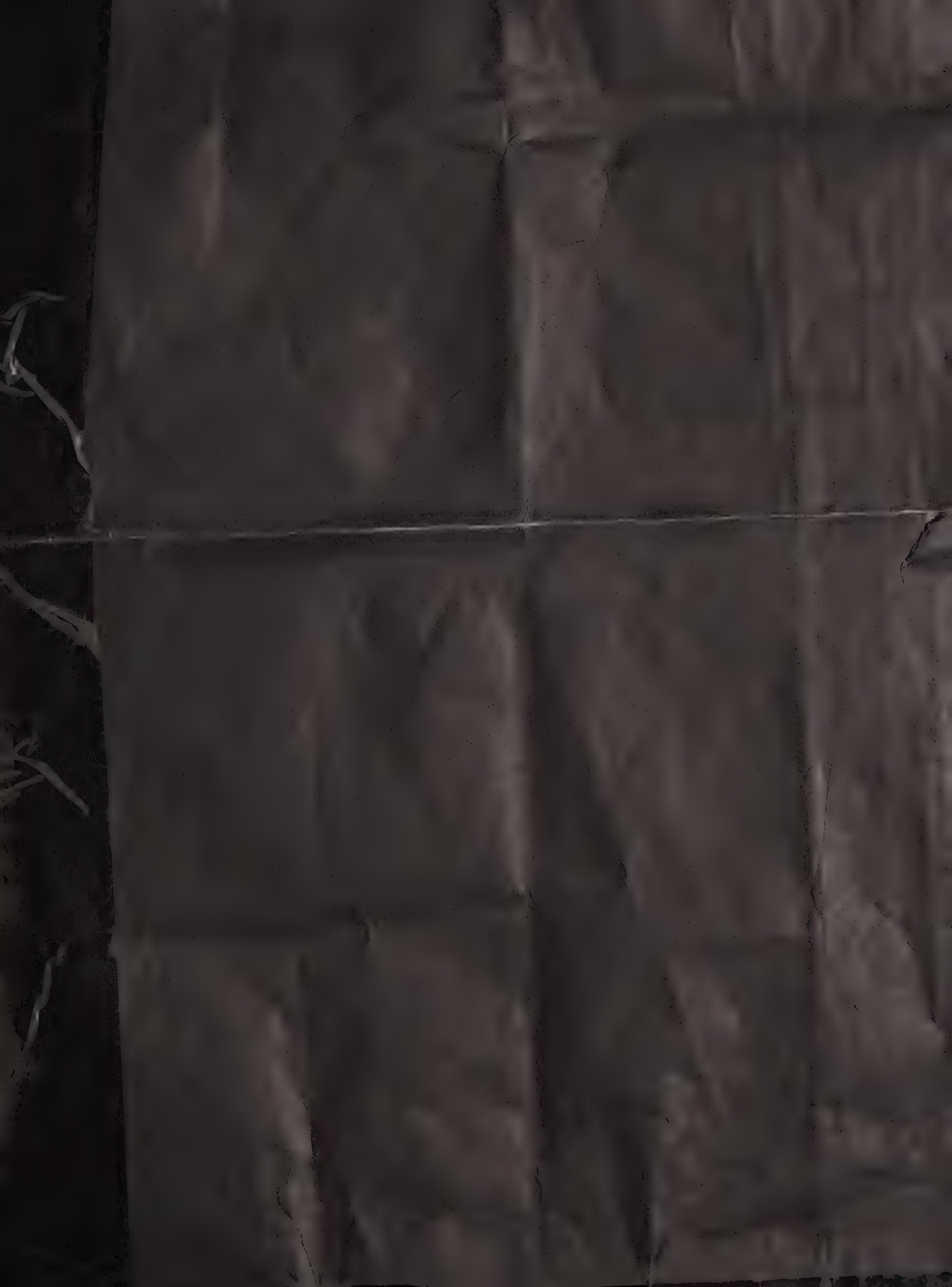
RV-10 XA, RV-10 XB, 1 ma CONSTANT CURRENT SUPPLY



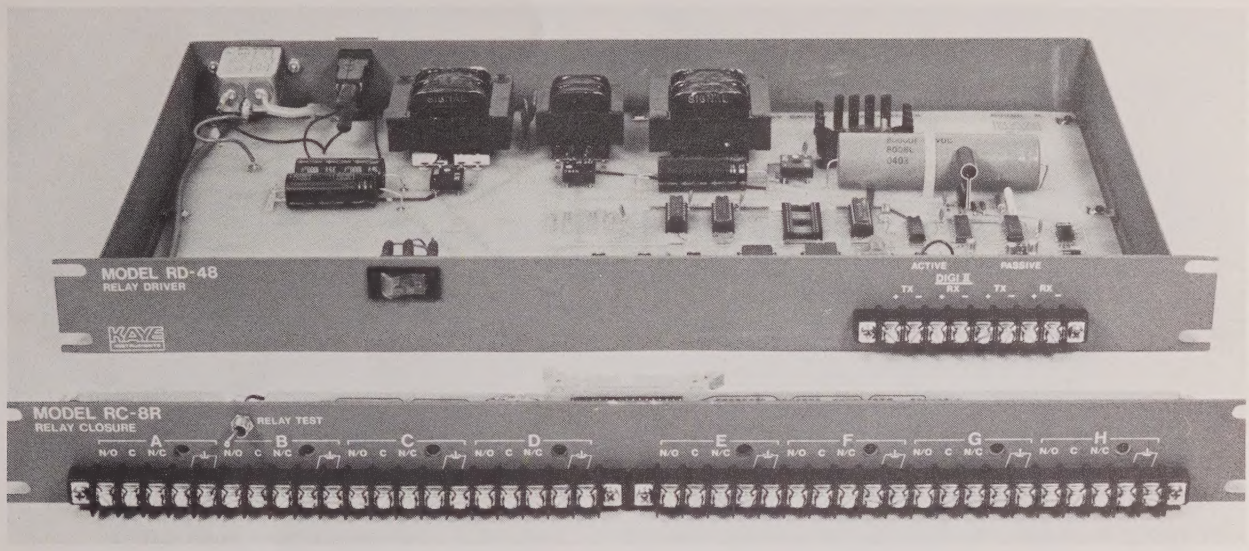
The RV-10X Constant Current Supply is intended for use in resistance measuring applications where a group of RTD's are connected electrically in series and excited by a single current source. This precision constant current supply also provides calibration voltage capability at 40mv, 400mv, 4V, and 10V. All voltage levels and current levels are individually adjustable.

Specifications:

Size: Rack mounting, 19″ wide, 3.5″ high x 2.5″ deep
Accuracy: ±0.01% of rated output
Output Current: 1.0000 ma, adjustable
Compliance Voltage: 16 V, (Max. external resistance 16,000 ohms)
Output Voltages: 10.000V, 4.0000V, 400.00mv, 40.000mv, adjustable
Power: 10 watts
RV-10 XA: 115V, 60 Hz
RV-10 XB: 230V, 50 Hz
Weight: 1 pound



DIGISTRIP RELAY CLOSURE SYSTEM



In addition to the two standard alarm relays included in every Digistrip Recorder, a relay system capable of operating 48 additional relays is available. This external relay system is capable of remote operation at distances up to 1.5 kilometers from the Recorder. There are two members of this relay family. The Model RD-48, Relay Driver Module, is a microprocessor based unit which receives a repetitive current loop data transmission from the Digistrip Recorder containing all active alarm relay numbers. This transmission is decoded and available to drive up to six Model RC-8R Relay Closure Modules. Each Model RC-8R contains eight relays. The Relay Closure Modules must be located adajacent to the Relay Driver Module as this communications link is via logic levels. The RD-48 has a repeater port for continuing the basic serial data stream. This permits alarms to be placed in multiple locations, or connections to be made to other terminal devices. Each separate relay rack location requires its own Relay Driver Module.

Each relay point has five front panel mounted screw terminals, three for the relay connections and two to implement latching. In addition, each relay has a LED indicator to show when the relay is in the energized state.

Each relay of the Model RC-8R has form C contacts (NO, NC, COM) with a 250 VAC 4 amp contact rating. The Relay Closure Module can be configured to provide either normally energized, or normally de-energized operation. Each relay may be configured for latching operation by installing a set of normally closed contacts on the two terminal locations provided specifically for this feature. Latching can only be implemented when relays are operated in the normally de-energized state.

All alarm programming is done at the Digistrip Recorder. Any of the 48 relays may be assigned to one or more channel alarms by assigning the appropriate relay number when in the program mode.

RD-48 Specifications:

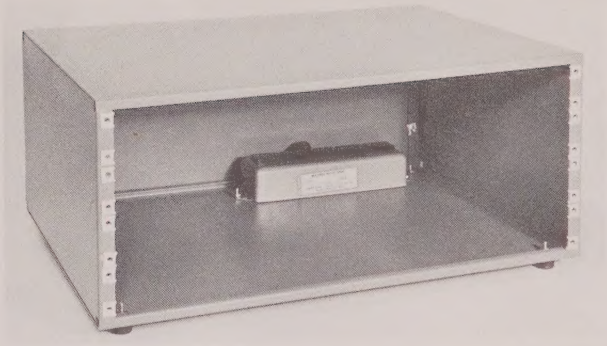
Size: Rack mounting, 19″ wide x 1.75″ high x 10″ deep
Power: 50 watts maximum, 115/230V, 50/60 Hz
Weight: Five pounds

RC-8 Specifications:

Size: Rack mounting, 19″ wide x 3.5″ high* x 1″ deep
(*Height increased on Rev. B)
Capacity: Eight Relays, form C (NO, NC, COM)
Closure Rating: 4 amp at 250 VAC, 3 amp at 30 VDC
Power: Power and logic received from cable supplied with RD-48
Weight: One pound

MODEL V0790 CABINET ASSEMBLY

This cabinet provides a convenient means to house system accessories. Removable rubber feet and a five plug outlet strip are included as part of the assembly.



Specifications:

Size: 7.5″ high x 14″ deep x 19″ wide
7″ nominal panel height
Weight: 14 pounds
Material/Color: Steel/Grey

VD100 PRECISION VOLTAGE DIVIDER

The VD100 is a precision 100:1 voltage divider. It mounts directly to the input terminals of a RAMP/Scanner or Digistrip Recorder. It provides a convenient method to reduce voltage levels to a compatible input voltage range.

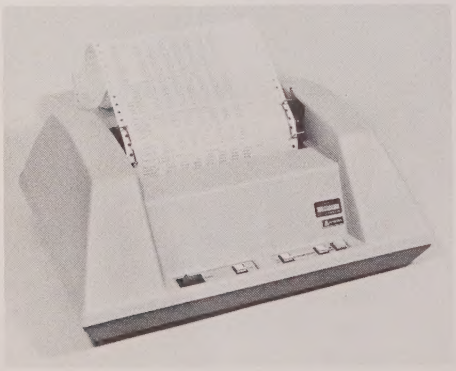
Specifications:

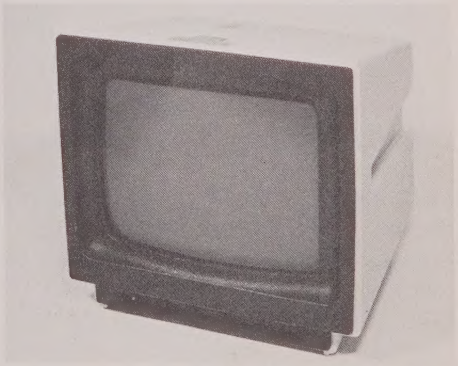
Size: .75 x 1.25″
Total Divider Resistance: 100K ohms
Divider Accuracy: 0.1%

Peripheral Devices

There are many recording and display devices which are compatible with the ASCII coded current loop and RS-232C serial data interface of the Digistrip and RAMP systems.

For the Digistrip series the interface is a standard feature. In RAMP it is an option. In both systems these computer compatible interfaces have programmable features. Because the range of compatible peripheral devices is constantly changing, the following are shown as typical.





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